CHEMICAL
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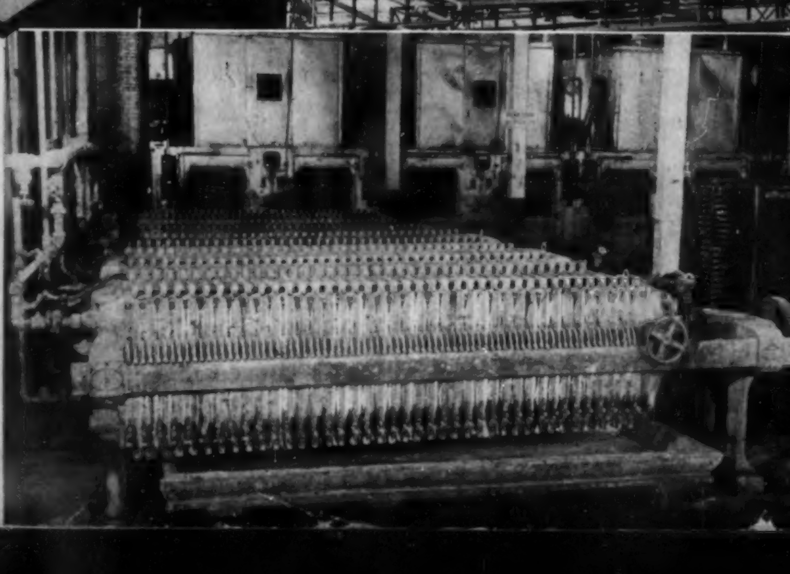
ENGINEERING



JUNE, 1943

"IT WON'T BE LONG NOW" SAYS MR. JEFFERS

"My notion is that by the Autumn of 1944 you can forget rubber as a problem in this country. There will then be enough for all needs." Basis for this good news is seen in 27 of 84 new plants now in operation. See pp. 98-102 and 140-3 for article and flowsheet on plants and operations at Institute, W. Va.

100-OCTANE'S COMING UP BUT MORE IS NEEDED

So reports Secretary Patterson as he visits inter-related aviation fuel, butadiene and rubber plants at Baton Rouge. Forty-five new 100-octane units are already on stream but twice that many will ultimately be needed to meet our increasing war demands. See pp. 129-32.

GETTING MORE OUTPUT MORE EFFICIENTLY

A typical batchwise, tank-burdened dry-color plant with its manifold products and rule-of-thumb methods has been streamlined to multiply production four-fold using less equipment and fewer manhours of labor. Read on pp. 106-10 how Reichhold engineers did it.

WASHINGTON NEWS
pp. 149-150.

CHEMICAL & METALLURGICAL ENGINEERING

ESTABLISHED 1902

In this Issue

JUNE, 1943

Volume 50 Number 6

An index to advertisers will be found on page 354

blished monthly. Price 35 cents per copy. dress communications about subscripns to Director of Circulation, Chem. & t., 330 West 42 St., New York, N. Y. bscription rates: United States, Mexico, ntral and South American countries, $3 year, $4 for two years, $5 for three ars. Canada, $3.50 a year, $5 for two ars, $6 for three years (payable in Canian funds). Great Britain and British sessions, 30 shillings a year, 60 shillings three years. All other countries, $5 a r, $10 for three years. Entered as second ss matter, September 3, 1936, at Post ice at Albany, N. Y., U. S. A., under act March 3, 1879. Contents copyrighted, 3, by McGraw-Hill Publishing Company, Branch offices: 520 North Michigan enue, Chicago; 68 Post Street, San Franco; Aldwych House, Aldwych, London, C. 2; Washington; Philadelphia; Cleveland; Detroit; St. Louis; Boston; Los Anles; Atlanta.

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Please change my address on Chemical & Metallurgical Engineering

From ....

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To ....

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Signed ....

Electrical Equipment—Weapons and Tools

From miniature motors to mammoth generators, from tiny detector tubes to great broadcasting stations—everything electrical is essential to our war effort

AS this editorial goes to press, newspapers and radio news commentators are telling the dramatic story of the blasting of two mighty Nazi power dams. Floods are sweeping down the Ruhr Valley, Germany's most vital munition production center. Two vast networks of industrial activity lie inert, for the great generators that had fed power to hundreds of plants producing war goods for Hitler, today stand idle. This daring raid will go down in history as one of the most, if not *the* most devastating of the entire war. It has destroyed two great sources of power, stopping the wheels in hundreds of plants and throwing into darkness thousands of factories and homes.

This epoch-making raid by the R.A.F. brings home to us the vital importance of our own power resources, those colossal generators from which flows the current that turns the wheels of our great industries, illuminates our factories and homes and runs our electric railways and subways. It makes us realize how dependent we are on electricity and how important is the part of those manufacturers who produce the electrical equipment that makes possible its generation and use.

Beginning with Thomas A. Edison, the inventive genius of electrical manufacturing men has devised more and more efficient ways of generating the current, better and better means of transmitting it and of applying it to do thousands of jobs quicker and better.

The products of electrical manufacturers have become so completely an essential component part of every industrial, business and domestic activity that our economy and our war effort could not go on without it.

In days of peace the laboratories of our electrical industry gave us radio, fluorescent lighting, infra-red drying, precision process-control, telemetering, split-second circuit breakers and many other things that border on the miraculous.

Today their facilities and their genius are devoted to an all-out war of wits with Axis scientists and production men.

Electricity plays a significant part in this war . . . from the "walkie-talkie" that brings support to hard-pressed outposts, to the mammoth motors on the battleships. While many electrical developments today are cloaked in secrecy, the nation will enthusiastically applaud these electrical manufacturers when the curtain is lifted.

The far-reaching importance of electrical instruments, apparatus and machines becomes evident when we consider that over 350 different electrical items go into combat vessels and that more than 170 go into a fighter plane. Most of these products are distinctly special in nature and are far removed from their civilian counterparts if, indeed, they have such counterparts.

To the civilian, a light bulb is something so standardized that every need can be filled by any nearby dealer. Our armed forces, by contrast, must have at their disposal more than 400 distinct types of lamps. Some no larger than the head of a match, are so brilliant that they flash signals under a tropical noon sky. Others are built to withstand extremely low temperatures, vibration, shock and many other abuses to which they are subjected.

On planes, for example, numerous fractional-horsepower motors are used but the standard industrial motor is not suitable for this service. New records in low weight-per-horsepower had to be achieved involving extensive changes in design and production.

To prevent the light from instrument panels from impairing the vision of night fighters, ultra-violet radiation which activates fluorescent instrument dials was developed. As a result, the pilot may look out into the darkness after reading his instruments without the least effect on his eyes. How many precious air victories can be credited to this one development alone?

But, in general, the story of this industry's war work is much too blurred by military censorship to afford an adequate picture of its contributions. The factories and shipyards that are turning out war matériel tell a more complete story. Many of these have been built during the past two years. Others have gone through a complete conversion process. In every case, large quantities of electrical materials were involved.

In the broadest sense, there are three major jobs which this industry has had to do, in addition to equipping our modern war machine. It has had to supply materials for the vast expansion of our industrial system, keep every plant fully maintained, and provide the necessary equipment for the vital power and communication fields.

More than $1,900,000,000 was spent for new industrial construction in 1942, and of this about 7% or $140,000,000 was for electrical materials. New machine tools and other production equipment required an additional $350,000,000 worth of electrical products. The conversion program called for another $145,000,000 of electrical apparatus and supplies.

This total of over $600,000,000 in itself would have staggered the electrical industry in a peace-time year. Yet, this record-breaking production was essential and had to be superimposed upon the direct requirements of the Army and Navy.

Industry depends upon electricity. Consider for a moment the effect of modern lighting upon war production. Industry enjoys levels of illumination and color quality that were undreamed of ten years ago. As a result, midnight shifts operate at daytime efficiency. As a matter of fact, many of the more modern plants have no windows at all.

Then there is maintenance. The failure of one single motor or feeder will stop a production line. Electrical manufacturers have had to stand at all times ready to

supply the heavy demand for the maintenance and repair parts that keep our industrial machine operating at top speed. Excess loads, 24-hour schedules and inexperienced production hands combine to shorten the lives of electrical equipment.

Electrical manufacturers have had to supply the greatly expanded needs of our power and communication systems.

New construction of all sorts — war plants, cantonments, war housing — has created a formidable need for additional capacity. Every element in our domestic economy has called for increased communication and power services. All this had to be superimposed upon the vast demands of our armed forces. The magnitude of this task is obvious but it is being successfully accomplished. Every old installation is functioning smoothly and every new one has been ready to function on exact schedule. There has been no failure either in our power or in our communication. Part of the credit for this performance belongs to the hundreds of manufacturers who delivered their products when and where they were needed.

This was not merely a problem of increasing production. These manufacturers had been depending on rubber, copper, aluminum and steel — all highly critical materials. For much of their non-military production they suddenly had either to find substitutes or practice the utmost economy and ingenuity.

Solutions to many problems were quickly found. Lighting manufacturers greatly reduced their use of steel by designing efficient, non-metallic reflectors. Wire and cable manufacturers expanded their use of synthetic insulation in place of rubber and they promoted the use of higher distribution voltages so that every ounce of copper would work more efficiently.

Steel is essential in apparatus that operates magnetically. There is no known substitute. But marked economies in its use have been achieved through the development of new alloys that are of increased magnetic efficiency. As a result, motors and transformers now consume substantially less steel than did units of equal capacity a year or two ago.

Electrical manufacturers have given our industries numerous new production tools. Infra-red heating tunnels, for example, have drastically reduced the time involved in production drying . . . in some cases from hours to minutes. High-frequency induction-heating has been spectacularly successful in the forging, brazing, hardening and casting of ordnance. Modern welding equipment makes possible speedy production with inexperienced labor.

America's production lines are being patrolled by electrical devices which eliminate human error. One million volt X-ray equipment looks through castings and points an unfailing finger at defects. An electronic flaw detector tests nonferrous drawn-metal tubing for imperfections. Other electronic devices are counting and sorting the products of thousands of war plants. Precision controls regulate all sorts of processes, from aluminum production to armor plate annealing.

These are but a few of many examples of the way in which the magic power of electricity has been harnessed to the war effort. Back of every development there is at least one electrical manufacturer — more often many — who have pooled ideas and methods with no thought of royalties or dispute over cost allocation.

No story of the electrical industry would be complete that did not pay tribute to those manufacturers who have dropped their normal lines in order to produce special war products. Many appliance manufacturers fall in this group. When war came, they did not stop to argue that civilian morale and big pay checks would demand a continued supply of their products, instead they quickly shifted to the production of war matériel and today they are deep in the manufacture of machine gun parts, aircraft sub-assemblies, and even gas-mask fabric. They have had to abandon their hard-won markets for the duration; but they are contributing mightily to permanent peace and a more prosperous world to which they will return when the guns are silenced.

This is the twelfth of a series of editorials appearing monthly in all McGraw-Hill publications, reaching more than one and one-half million readers, and in daily newspapers in New York, Chicago and Washington, D. C. They are dedicated to the purpose of telling the part that each industry is playing in the war effort and of informing the public on the magnificent war-production accomplishments of America's industries.

This great industry has increased its production threefold in two years — $2,500,000,000 in 1940 to $7,500,000,000 in 1942. It has done this with all the zest of youth, for this is a young and a pioneering industry. Few companies in this industry are fifty years old; the majority are much younger. Top management in general is young, too, and many outstanding technical developments have come from the brains of men just a few years out of college.

The results of all its intensive intelligent work can be found in every factory, on every battlefield and ocean, and even in the flak-spotted air over Berlin. In a sense, the electrical manufacturing industry stands beside every soldier and every sailor as he goes into action. It has a place of honor it richly deserves.

And when this war passes into history, as it surely will, our soldiers and sailors returning to peace-time jobs, will find a life greatly enriched by electrical developments that were undreamed of yesterday.

James H. McGraw, Jr.

President, McGraw-Hill Publishing Company, Inc.

CHEMICAL
& METALLURGICAL
ENGINEERING

ESTABLISHED 1902 JUNE, 1943 S. D. KIRKPATRICK, *Editor*

AFTER THE PIPELINES ARE FILLED

BEFORE "Big Inch" can deliver to the Eastern Seaboard its daily capacity of 300,000 bbl. of petroleum products, many times that volume will have been pumped into its Texas terminals. Almost two weeks will have been required to fill the huge pipeline with its 4,000,000 bbl. backlog. After that, of course, its operations will be geared to the actual needs of the consuming market.

Something comparable to this process has been underway in the plants and industries supplying war goods. Most of them have been working at full speed and straining their production facilities in order to turn out the tremendous quantities of supplies needed to equip our troops in many widely scattered theatres of war. That these great stores or stockpiles are essential to any successful military campaign was gloriously demonstrated in North Africa. It was both the quantitative as well as the qualitative superiority of American weapons and supplies that overwhelmed the Nazi Afrika Korps.

But, again, once the pipelines have been filled—and we are already approaching that fortunate position in some lines—then our munitions production will have to be geared to the actual demands of the consuming market. Some have estimated that by the end of 1943 we will have been equipped to meet the basic needs of a 10,000,000-man army of our own as well as the probable requirements of our Allies. Certainly by the middle of 1944 we shall have passed the peak of production and may expect some tapering off—if not drastic reductions—in war orders. There have already been cutbacks in the tank program, and for some types of ammunition and explosives. There has even been a noticeable lessening of the pressure on magnesium and the suggestion made that it should be diverted to other uses—for example, to replace aluminum in plane wings and fuselages. In some quarters this has aroused hope for revival of civilian supplies or at least the release of sufficient metal for research on postwar products.

Such thinking, we feel, is still premature. The Army and the Navy are determined that production schedules in the war industries are to be adjusted to their changing needs without easing up on the allotments of critical materials for civilian uses. Some military authorities argue that in time of war we can't have too much of anything. Others are fighting to put across the principle of "the fluidity of war," i.e., that the art of fighting changes so rapidly that we can never hope for accurate anticipation of its exact needs. Weapons can become obsolete almost overnight and must be redesigned and improved. The same theory applies to explosives and chemical munitions.

All this is naturally confusing to most of us. On the one side we see cutbacks and shutdowns and on the other the insistence that competing projects be completed and new ones launched. Lacking the whole picture, the parts just don't seem to make good sense. So we must, for the time being, rely on the judgment and policies established by the military authorities. We must continue to build stockpiles where and in the volume wanted. We must be prepared to readjust and even cancel our contracts to meet the changing demands of war. But as technical men interested in the future as well as the present, we can start thinking and planning now for the creative and constructive achievements that must follow our present job of death and destruction. Filling the pipelines is just the first long step toward the inevitable victory.

FREE TRADE vs FREE INITIATIVE

CONGRESS has been debating the way in which the President is to continue negotiations of reciprocal trade agreements. That question has long-time significance because agreements negotiated from now on will undoubtedly extend beyond the war period and largely influence postwar trade and international relations.

At that later time it is to be expected that many agreements will be reached permitting much more extensive movement of goods throughout the world. Many have come to believe that trade barriers are a cause of war; and that tariffs are of relatively less importance for the protection of domestic industries. Hence American enterprise can probably expect much more competition from imports, and may face the prospect of much lower tariff rates than in any time during the present generation.

If international trade is stimulated constructively for the benefit of all peoples, it will ultimately help the United States as well as the rest of the world. But there is no gain in having the standard of wages, and the standard of living, in the United States lowered simply because other parts of the world have not been successful in equaling our standards. It is going to be a difficult thing to steer between creating unreasonable competition for American wage earners on the one hand, and unfair restriction of international business on the other.

Chemical enterprise demonstrates one important possibility for escape from both of these difficulties. It lies in the stimulation of large-scale low-cost American production with highly paid labor using heavy investments in engineering and plants. If the American government wishes to provide opportunity for success and survival of American enterprise without unfair treatment of the rest of the world, it will have to figure on providing freedom of initiative and free play to inventive genius and organized research and development work.

The rest of the world may safely use older methods where lower standards of wages prevail. This country dare not. Not only industry, but also the workers' standard of living, will collapse if not supported by enterprise which has every opportunity for lowering of costs and lowering of prices without cutting of wages. This is not a new principle but it is one much too often forgotten in governmental circles.

WATCH PILOT-PLANT COSTS

INVESTMENT in engineering equipment for development work in pilot plants is often of substantial magnitude. The bookkeeping methods used by a company may at times largely affect the overall net cost of the work. In the long run this may determine the quantity of research and development that can be financed. It thus has significance for the stockholders and the public, both of which will benefit from successful projects.

In some cases the entire cost of research can be charged off as an operating expense of the company. This, of course, is an advantage because it means that the immediate burden can be assumed before taxes are calculated, just like labor or raw material costs.

But that is not always practical when development work extends into pilot plants which become, in fact, small manufacturing units. There the cost keeping must for tax-return reasons be comparable with other production procedures. However, there remain essential differences that are not always adequately taken into account. For example, there is the fact that such capacity in a small pilot plant has a very short life and the depreciation or obsolescence rate is extremely high.

Generalizations on this subject are difficult, but one broad principle is clear. Investment in equipment for pilot-plant manufacture should be depreciated at a much higher rate than standard equipment in a going concern of a permanent nature. Perhaps some research executives have not appreciated how the overall net cost to the company, taking account of taxes, is substantially affected by this procedure. It is worthy of careful review.

O.P.R.D.'s INSURANCE POLICY

EXTENSIVE chemical engineering development is being carried out on new processes for making alumina and magnesia as raw materials for the manufacture of light metals. Some of the new procedures for processing unusual raw materials or those of low grade formerly rejected, are very promising from both technical and economic viewpoints. Others are less attractive but still worthy of early study on a pilot-plant scale.

Some of this work is being planned, and partly financed, by the Office of Production Research and Development. (See pp. 112-113 of this issue.) That agency is wisely taking the stand that it must anticipate troubles, not merely seeking to escape from them after they have arrived. The alumina program well illustrates this policy, which is worthy of careful consideration by many other divisions of industry.

It is obvious that high-grade bauxite from Dutch Guiana cannot continue to come in at all times in indefinite quantities. Good sense demands that alternate raw materials be studied. Much domestic bauxite of low grade, alunite, the "red mud" discarded by alumina operations of the past, and other aluminum-bearing rocks and minerals, all are being considered. A wide variety of processes for these various raw materials has been reviewed. Even a few "long-shot" plans are being tested. The overall program may well give government officials some assurance of fundamental scientific knowledge and sound engineering practice.

If and when a serious bauxite shortage should develop, chemical engineers will have ready alternate raw materials and methods to use them. It is most unfortunate that we did not adopt this policy of technologic insurance years ago with respect to many mineral raw materials and various chemical-engineering methods. The investment that formerly seemed a bit extravagant now appears to have been an unused opportunity for very cheap insurance against great difficulties that have since proved vastly more costly than any amount of early research and development would have been. (We might even mention synthetic rubber as another example.)

SOWING FOR THE POSTWAR HARVEST

It would be immensely helpful to the war production program, as well as to postwar readjustments, if representatives of chemical management and labor would now insist upon inserting in every collective bargaining contract certain standard provisions that would require impartial umpires for settlement of all labor disputes.

A recent report of the U. S. Bureau of Labor Statistics has shown that of some 84 agreements in chemical companies, only 56 (covering about 50 percent of the workers under agreement) provide for automatic, impartial arbitration of unsettled disputes. It is assumed that in most of the remaining 28 contracts, irreconcilable disputes are expected to be settled by the primitive methods of Mr. John L. Lewis. For such a condition to continue to exist unchallenged in one of our most progressive industries reflects adversely on our decency and our intelligence.

It is crystal clear to all but the prejudiced that, with arbitration as a final step, both management and labor can still retain full control over their own rights under their labor agreements. Local labor relations problems may thus be amicably settled by an umpire on the scene who can, by and large, do a better and quicker job than can be done by distant agencies. There is no compulsion nor any use of economic force connected with such a policy of arbitration. It is purely a voluntary method based on the use of intelligence.

Voluntary arbitration would not only give industry greater stability, but it would also sow the seed for a new crop of more friendly relations between labor and management. Such seed now sown and properly cultivated will mature in time to yield a golden harvest for chemical industries in the postwar reconstruction period.

WASHINGTON HIGHLIGHTS

PLACEMENT of professional and technical personnel is "assured" by the U. S. Employment Service, according to publicity emanating from Mr. McNutt's office. All kinds of scientific and engineering specialists are promised jobs comparable with their training and skill. One wishes that there were any real chances for the promiser to make good on this matter. Most professional personnel still available for essential work will probably shy away from this new placement division.

MINIMUM WAGES for a variety of process industries closely related to chemical manufacture will be set by the Wage-Hour Division's special "Industry Committee No. 60" if the Department of Labor has its way. This war-time effort seems to include one questionable motive. Some think that during a war period a much higher minimum wage for common labor can be set, especially in the South, than would be possible after the war.

COTTON LINTERS are now being offered for sale by Uncle Sam. High-quality material not needed by the government amounted to 4,500 bales for a first offering. This is another evidence that early estimates and raw material plans for smokeless powder manufacture were greater than the actual need which has developed. This fact was well disclosed previously in the curtailment of ammonia plant capacity by governmental orders. But no one can rightly infer that general manufacture of munitions has in any way slowed down. That result would not be expected until at least the continent of Europe is under Allied control.

COAL will cost more in the near future, probably indefinitely. The price floor under this fuel may not be continuous; but it is certain that a wage problem of such great social and political importance as this will not be forgotten even in the post-war era. Whether or not further nationalization of coal mining is achieved, an objective of some officials, the influence of federal management continues to raise costs, and hence prices. Those who now necessarily use coal for industry, instead of unavailable oil, may find a reversal of this trend very important in the postwar period.

MINERAL SUPPLY, including raw materials for chemical process industries, is to have further support from additional development of small domestic mining enterprises. The way in which this new policy has been publicized again demonstrates that preparation of materials for war usage is an important item in the political plan, especially for the Western mining states. The new policy formulated by WPB was announced by a group of Senators as a result of a letter from the President to Senator Murray of Montana. The need for certain of these raw materials is unquestioned. As much cannot be said for much of the technique of development. Already it is evident that building of stockpiles in the postwar period is likely to be a political venture of large economic significance. Perhaps user industries can take some comfort that stockpiling of important mineral products from domestic sources is at least less objectionable than the silver purchase policy previously used for like political purpose.

HOGS may yet eat the nation's corn cribs down to starvation levels. The alarming ratio between the price of pork on the hoof and the cost of feed is furnishing exaggerated inducements for raising hogs. The result will disturb the food industries and react on many other industrial fields where the processing of agricultural materials is effected. Hence, we should do all we can to support Chester Davis in his program for a more normal relationship.

EFFICIENCY is officially discouraged by an O.P.A. ruling that manufacturers of rayon products must pass on to their customers any and all savings made in manufacturing processes. The intent of O.P.A. apparently was to protect the public against getting an inferior product at the price ceiling formerly applicable to a superior article. There should be no quarrel with that intent but the unfortunate effect may well be to discourage any further improvements that would add to the efficiency or the economy of rayon production.

SAFETY LABELING cannot be ignored, even in war times. Thus the new American Standards Association recommendations for the marking of pressure cylinders containing chemical gases are a worthwhile effort that will have general usefulness. Also important are proper labeling and other precautionary measures for such household poisons as insecticides and disinfectants. Now that victory gardens are springing up everywhere there is an extra incentive for the industry to speed a sound national program for labeling and coloring of insecticides.

GR-S RUBBER

West Virginia's Synthetic Rubber Plantation

JAMES A. LEE *Managing Editor, Chemical & Metallurgical Engineering*

Chem. & Met. INTERPRETATION

Here are descriptions of processes that have been closely guarded secrets. They are published with the approval of government officials. The process for making butadiene from alcohol was selected as the best of several developed by Carbide & Carbon. The styrene plant is of interest not only because of the use of this material in synthetic rubber, but also due to the promising future of polystyrene resins in our postwar economy. Production of the copolymer offers chemical engineers much that is new and interesting.—*Editors.*

The Institute (W. Va.) Buna S plant is a symbol of the ingenuity of the American chemical engineer. Construction work was started in April, 1942. The first butadiene was produced in January, the first styrene in April, and the first rubber in March, less than a year from the date of the start of construction. The rated capacity of this plant is 90,000 long tons of synthetic rubber per year, which is about one-seventh of the rubber consumed by the American people in normal years. To produce this same quantity of natural rubber would demand a plantation of 270,000 acres, containing 24,000,000 trees, and requiring 90,000 employees.

The butadiene and styrene units were designed and constructed and are being operated for the government by Carbide and Carbon Chemicals Corp. The copolymer plant was constructed and is being operated by the United States Rubber Co. Ford, Bacon, and Davis, Inc., was the principal contractor and the equipment in the copolymer plant was fabricated and installed by Blaw-Knox Co.

The chemicals plant consists of four units for the production of butadiene from alcohol, each unit designed for a capacity of 20,000 short tons; and two units for styrene from ethylene and benzol, each having a rated capacity of 12,500 short tons per year.

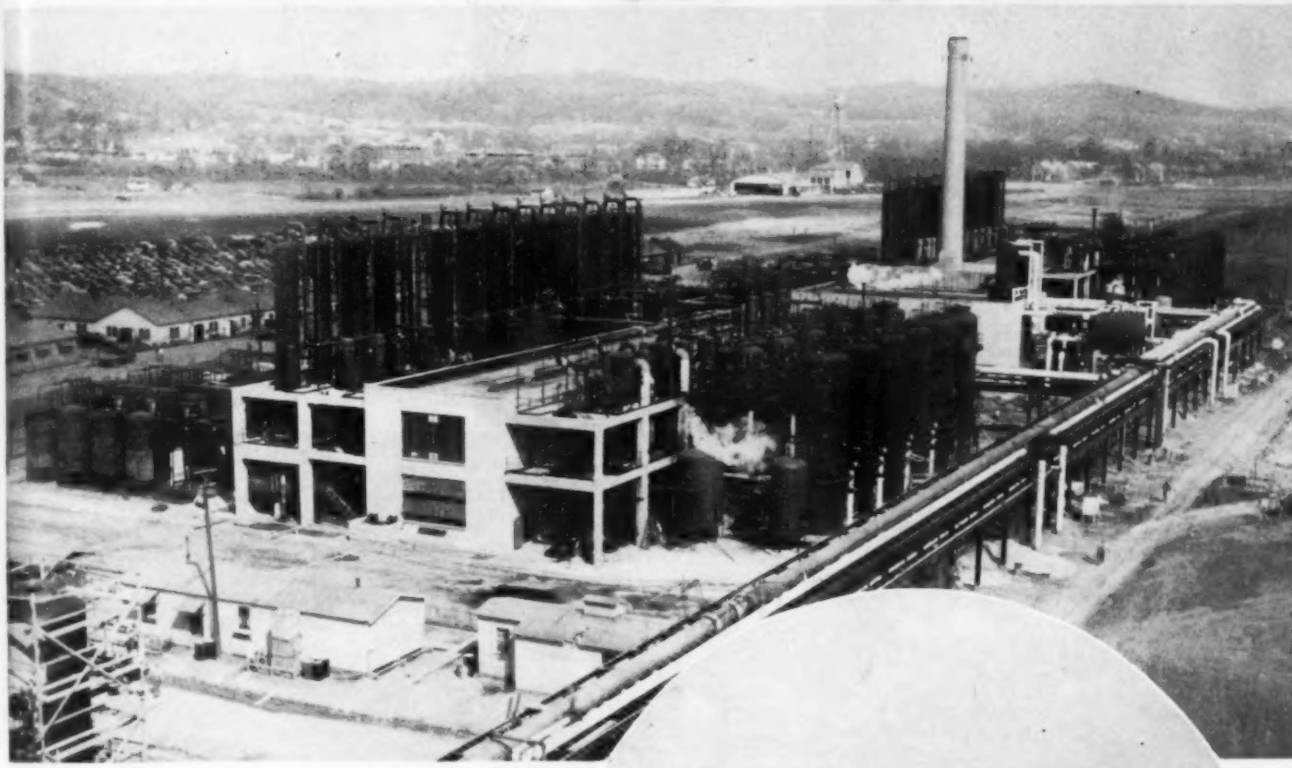
Carbide and Carbon Chemicals Corp. chose the process for making butadiene from alcohol as the best, under the existing circumstances, of several which it had developed through research. The chemical reactions involved in this process had been known for years, but their commercial development on a large scale basis under local conditions was new. The alcohol process, the company's engineers were convinced, had three important advantages, (1) It could be applied with the smallest volume of critical materials for the plant, (2) It could be put into production in the shortest possible time, (3) It would produce butadiene of exceptionally high purity.

Carbide and Carbon put this new process to test and gave its engineers opportunities to learn all they could about butadiene plant construction and operation by building a pilot plant, which was put into operation in June, 1941. As experience was gained, this plant was frequently modified.

Present plans call for the major source of the alcohol used for producing butadiene at this plant to be that derived from the fermentation of grain. To supplement this, ethyl alcohol made from molasses, and some synthetic alcohol made from petroleum gas, can also be used when, and if, necessary. At present the alcohol is shipped in tank cars and an occasional tank truck to the Institute plant. It is expected that in the future it will also be delivered by barge as the plant is located on the navigable Kanawha River.

Alcohol is stored in five 1,500,000 gal. tanks. From these storage tanks it is pumped to the distillation system where it is vaporized and passed onto the converters, vertical tubular vessels. The tubes contain the catalyst. Several of the converters produce acetaldehyde which is then combined with the alcohol fed to the remaining converters. The product from all converters is cooled by heat exchangers and condensers. The uncondensed gas is scrubbed under pressure to recover the valuable materials. Condensate and scrubber liquor are combined and fed to a single set of continuous stills in which the butadiene and unreacted materials are purified. Butadiene which is more than 98.5 percent pure is stored in spherical pressure vessels holding 250,000 gal. each.

The butadiene condensers are located on the second level and the refluxes are pumped to the top of the column. The stills are heated by external, natural calandrias. Use is made of high boiling organic fluid to supply heat to the converters. The equipment is almost entirely plain carbon steel, no stainless is used, and a minimum of copper was specified, in



Two of the butadiene units at the Institute (W. Va.) plant with their source of process heat in between. The product is stored in Hortonspheres. A catalyst building is shown nearby

an effort to do without critical materials. It is interesting to note that for the pipe racks the company used a section of the Brooklyn elevated railroad structure, which had a short time previously been dismantled.

Just prior to the realization of the rubber emergency, a new process had been developed for producing styrene of high purity. This process was originally intended for making styrene for polystyrene resins for the Bakelite unit of Union Carbide and Carbon. It was as though made-to-order for the synthetic rubber program.

It was decided that a 25,000 ton a year styrene plant be built at Institute, even though actual construction had been started on a plant half that size at the Carbide and Carbon's South Charleston plant. Work began on the large styrene plant in July, 1942, and the first operation of the plant took place in April of this year, just nine months later.

Raw materials for the styrene units consist of benzene which is brought to the plant from the Pittsburgh and other areas, and ethylene which is made in large volume at the South Charleston plant about six miles distant, and delivered to Institute by pipe line.

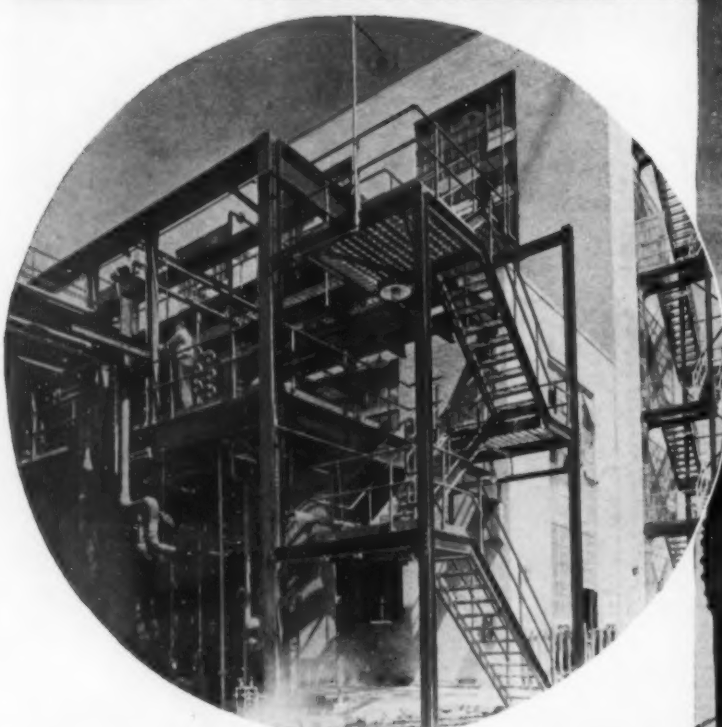
The benzene is first treated to remove the sulphur and sulphur compounds, principally thiophene. This is done with sulphuric acid in batch working tanks equipped with agitators and a small diameter settling chamber at the bottom. The purified benzene is next dehydrated by distillation and fed to continuous alkylation reactors where ethylene is added in the presence of a catalyst. Part of the benzene is converted to ethyl benzene and part to polyethyl benzene. The reaction product then flows to an alkylation reactor where more benzene is added and part of the polyethyl benzene is then reacted with fresh benzene to revert to ethyl benzene. This mixture is distilled to remove unreacted benzene and polyethyl benzene which are returned to the process.

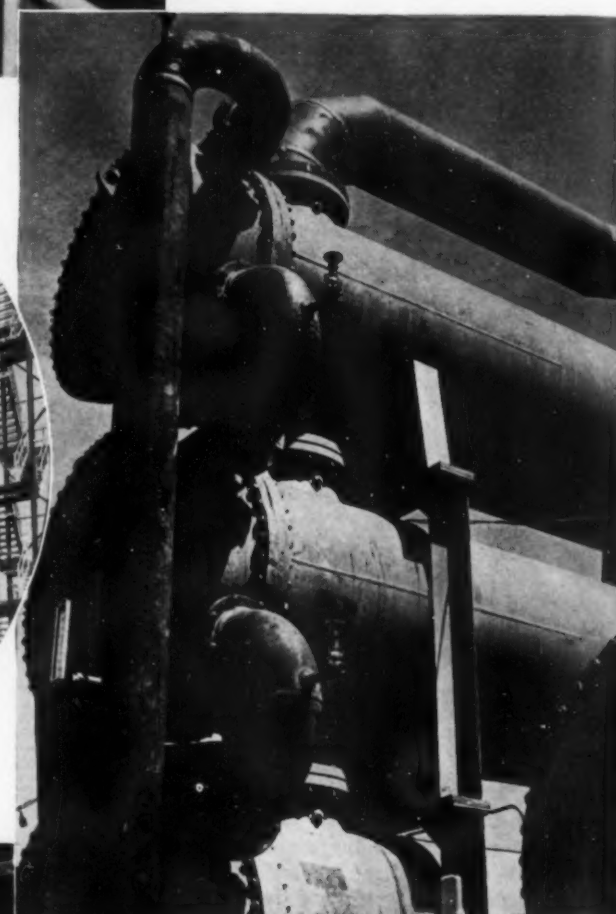
Purified ethyl benzene is then converted to styrene by a unique process which avoids the troubles and difficult separation of ethyl benzene from styrene by distillation. The entire process is continuous except for the first step of benzene purification. The final styrene product has a purity over 99 percent. It is stored in refrigerated tanks.

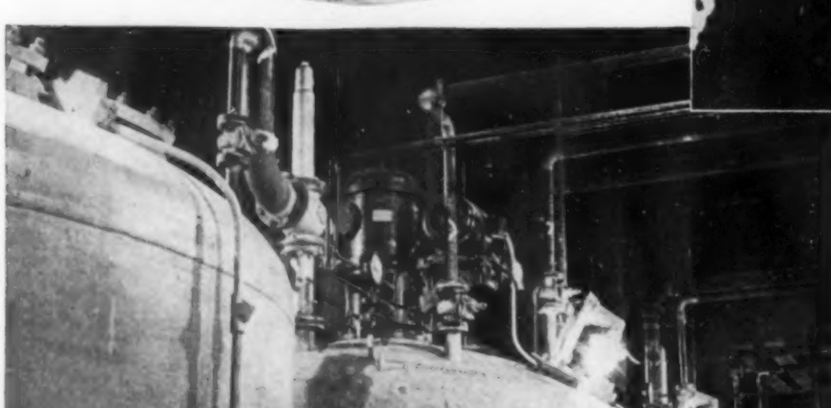
The stills in the styrene units are made of both copper and stainless steel. This is necessary as some of the byproducts are corrosive. Styrene

is handled and stored in plain steel. In conjunction with the styrene units a heating furnace is operated in which a high boiling organic liquid is vaporized to provide process heat. The stills, compressors and most pumps are indoors. Reactors and storage tanks for intermediates are out of doors.

The polymerization plant was built and is being operated by the United States Rubber Co. for the Defense Plant Corp. It is essentially a standard plant constructed to plans de-







Operating level between rows of conversion vessels in a butadiene unit

One of the converters in a styrene unit appears at left. Stills, compressors and most pumps are under cover

Unreacted butadiene is flashed off from the rubber latex in the rubber plant. It is condensed in the condensers shown above

Polymerization takes place in large glass-lined reactors. There are 72 such reactors for the annual production of 90,000 long tons of synthetic rubber

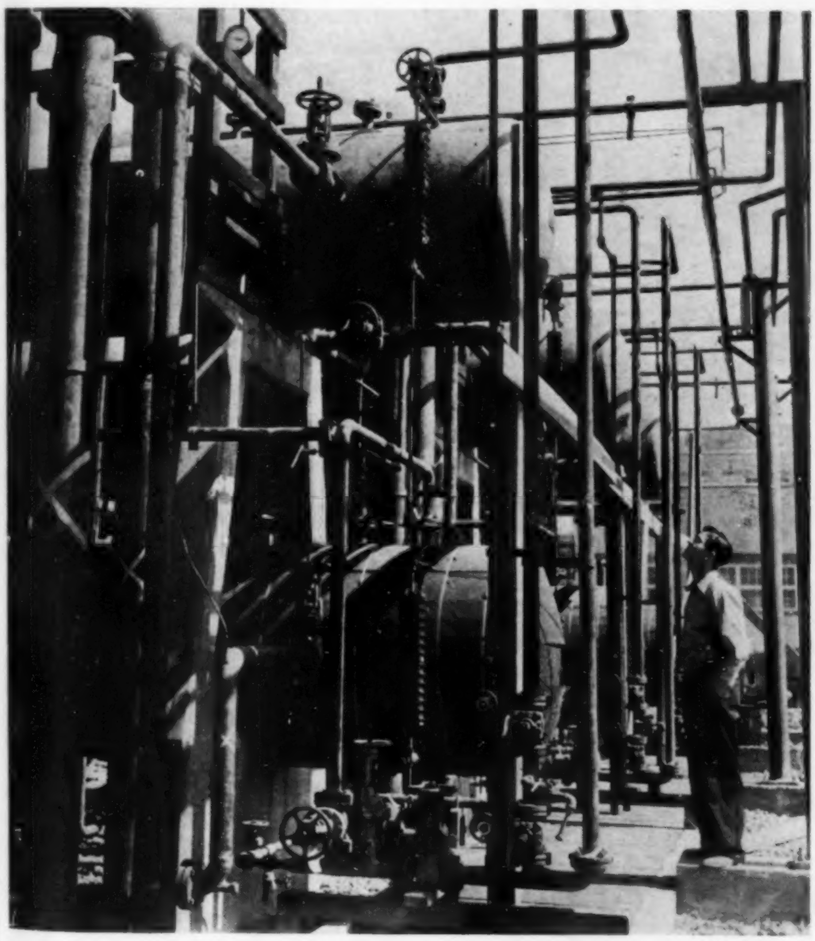
veloped by a committee of engineers from four rubber companies, and fabricated and installed by Blaw-Knox Co. This plant is composed of three identical units, each with a capacity of 30,000 long tons of rubber annually.

The butadiene and styrene are pumped through a pipe line from the adjacent chemicals plant and as they enter the grounds of the polymerization plant they are metered. The storage tanks at this plant, because of the nearness of the source, were designed to have capacity for only a few days operation.

All tankage containing butadiene is provided with safety valves. These discharge through a collecting system of pipes into a main line which terminates in a water seal at the base of a 150 ft. stack. A perpetual flame burns at the top of the stack to ignite combustible materials which may issue from safety valves throughout the plant. Inert gas is bled into this collector system so that at all times the entire safety flare will be filled with inert gas to avoid the forming of explosive mixtures. The water seal at the base of the safety flare serves as a flame arrester between the top of this device and the collector pipe.

All of the styrene storage in the tank farm is vented through a separate collector line which terminates over a dyked basin with approximately one and one-half times the holding capacity of the total styrene storage facilities. The entire hydrocarbon storage is dyked and provided with a fire protection system.

Other ingredients such as soap, catalyst, salt, acid and caustic are delivered to the plant by rail. Some of these raw materials are stored in a building at one end of the unit. Adjoining this storage is the chemical make-up building. Here the catalyst for the polymerization is prepared, and the antioxidant, the soap solution and the reaction arresters are made. From here these materials are transferred by means of pumps to the meter room in the reaction area.



An inhibitor is added to butadiene in storage to prevent premature polymerization. It must be removed before butadiene is pumped to the reaction area

The rock salt is delivered to the plant in gondola cars and is dumped into underground concrete storage pits. The salt is flooded with water to prepare a saturated brine which is treated in a purification system to remove the calcium and magnesium contents of the brine. If these impurities of the brine were not removed they would eventually be precipitated in the synthetic rubber as salts of fatty acids and would interfere with the electrical quality of the rubber. They are considered by some operators to be the cause also of poor processing quality in tire building operations.

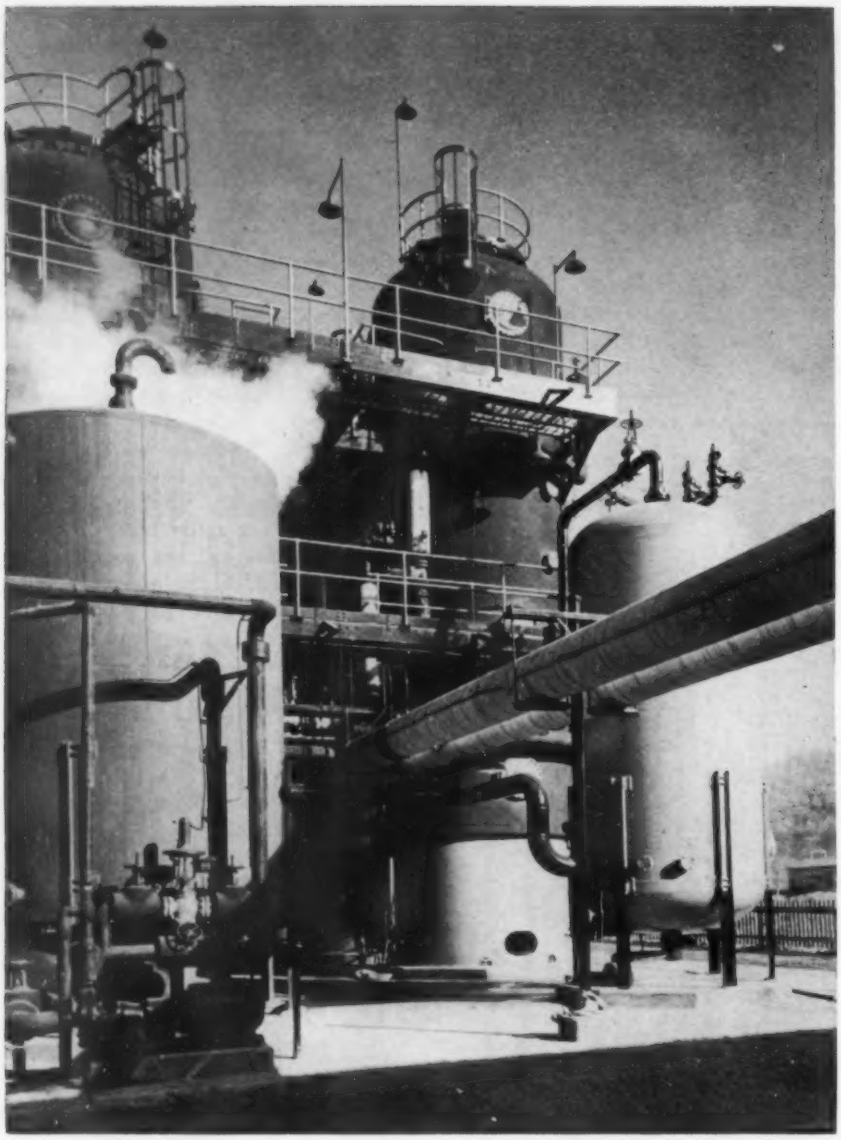
The reactors are water jacketed, glass-lined and equipped with agitators. They are provided with hot and cold water circulating system for the exact control of reaction temperature. Cooling water circulates through stainless steel coils inside the vessel. In order to seal the volatile butadiene against loss from stuffing boxes, a special Dura-metallic seal is used which operates on the principle of sliding metallic rings, working under a positive 100 lb. oil pressure to prevent the loss of volatile material. Each reactor is provided with a combination fangible disk and spring tension type of pressure relief value discharging through a collector system of pipes to the safety flare. The agitators are of special design which conserved a substantial amount of stainless steel. Throughout the plant, the use of special steels containing chromium and nickel has been held at an absolute minimum.

The charge of butadiene, styrene and soap solution emulsion is passed through liquid displacement meters, while the catalyst and other materials are measured in weigh tanks. All except the catalyst passes through a common header in order to prevent charging the several materials in layers. Conditions of reaction are controlled by means of a group of temperature and pressure recording controlling devices. The control room and meter room are held under a small positive air pressure as a safety measure, since instruments of the type in use are not spark proof.

Each set of 12 reactors is provided with a tank which is located between the collector system of the safety relief valves and the safety flare. This is simply an emergency provision which will prevent large volumes of soapy, foamy reaction mixture from entering the safety flare lines.

When the proper stage of polymerization has been reached the latex in the reactors is blown down by its own pressure to blow-down tanks in which the polymerization reaction is arrested by addition of certain agents. Each one of these tanks is large enough to hold the contents of three reactors. From this point the process becomes continuous.

The latex is pumped to glass-lined



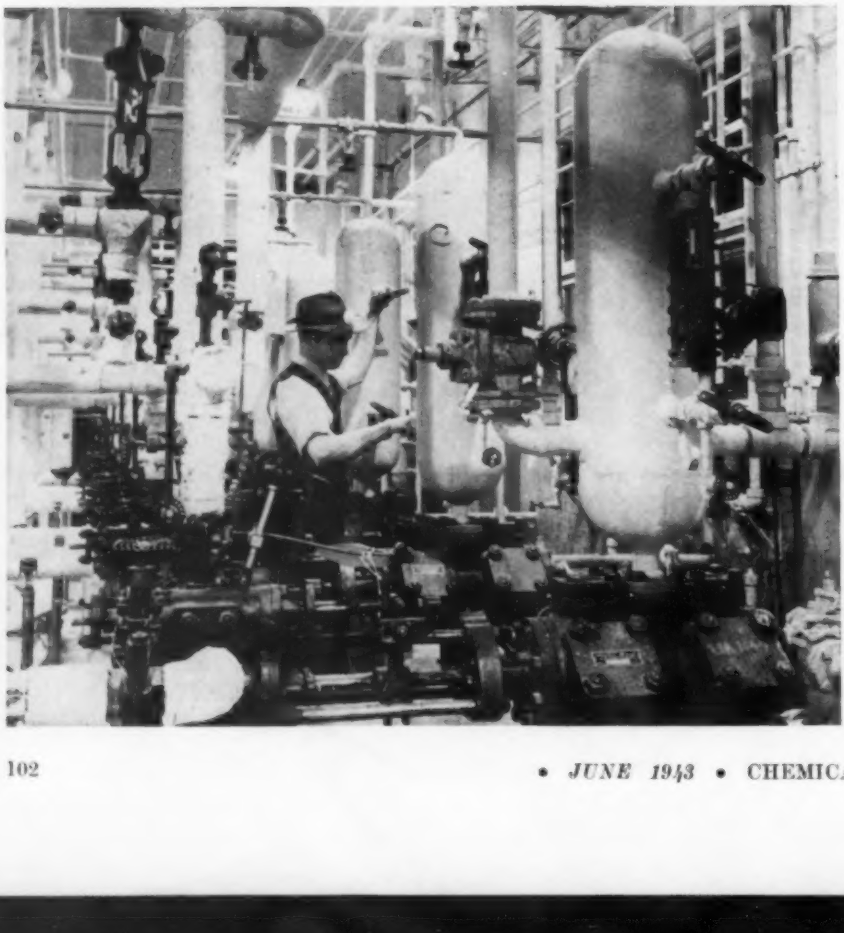
Steam and hot diphenyl vapors enter a butadiene unit through these pipe lines. This is a corner of one of four such units operated by Carbide & Carbon at Institute, W. Va.

flash tanks where the unreacted butadiene is removed in two stages. The butadiene is collected in a receiver and recycled until no longer useful. From the flash tanks the latex passes to a series of strippers where the unreacted styrene is separated. These glass-lined tanks are operated at various temperatures and degrees of vacuum. The styrene, like the recovered butadiene, is recycled.

Latex, free from butadiene and styrene, is conveyed by diaphragm pumps to several 30,000 gal. concrete blending vats, where it is mixed with many other batches for the sake of uniformity. Here the antioxidants are added in the line by means of proportioning pumps as the latex enters the vat.

From the blending vats the latex is pumped to a wooden creaming tank where brine is added to flocculate the rubber particles. Next it goes to the coagulation tank and the soap conversion tank where acid is added and the soap is converted to fatty acid. The mass is transferred by Duriron pumps to the riffler box above an Oliver rotary filter equipped with squeeze press rolls. The mass as it reaches the filter contains about 5 percent solid rubber. The dilute acid solution is first removed and stored for reuse. The rubber crumbs are then washed free of acid and conveyed by a rubber belt to a large disintegrator. It then enters a tunnel dryer and is conveyed the length of the dryer three times. The product is fed to the top belt and transferred progressively to the second and third belts for complete drying. From here it falls onto a screw conveyor and is elevated to a belt which feeds the scales. From these it is compressed into 75 lb. blocks in an automatic baler and placed in cardboard containers for storage and shipping. The bales of Buna S are shipped to rubber factories for processing into finished articles on the same machinery as is employed for natural rubber.

A *Chem. & Met.* pictured flowsheet covering these operations appears on pages 140-143 of this issue.



The raw materials, butadiene and styrene and many special chemicals, are moved by pumps from storage to the reactor areas at the plant operated for the government by the United States Rubber Co. at Institute

Rebuilding Used Equipment For The Process Industries

NORMAN G. FARQUHAR *Assistant Editor, Chemical & Metallurgical Engineering*

Chem. & Met. INTERPRETATION

Wartime shortages are bringing to light some sources of chemical process equipment which hitherto have been little known. Not the least of these are the reputable second-hand machinery dealers who are prepared to do a thorough job of rebuilding and reconditioning practically all types of plant equipment for the chemical process industries.—*Editors.*

It is natural that when metals and machinery are scarce, the reconditioning of used equipment should take on added significance, for here is one way to put back quickly into the production line those badly needed units which otherwise would be sent through the long costly cycle of scrapping, remelting and refabrication. Companies engaged in the reconditioning of process equipment now find themselves filling high priority orders for government arsenals and defense plant corporations as well as private industrial plants. Some plants have required expansion during recent years to handle this increased volume of business.

Among the various sources of used equipment are plants which have made changes in their processes or have actually ceased operations entirely. Often complete process plants are purchased and the machinery rebuilt and sold separately to individual purchasers. In general, the customer's order and specifications are received before rebuilding is begun. This procedure permits the buyer to get exactly what he needs, even to extensive variations from, or additions to, the original piece of equipment. It also prevents accumulating an excessive inventory of reconditioned equipment. Considerable work is done in motorizing and otherwise bringing up to date the used pieces. Occasionally, an item may be sold "as is," but this is not general practice, especially in the case of equipment such as finely balanced centrifugals. If careful inspection reveals worn or damaged parts which could not be satisfactorily repaired or replaced, the machine is scrapped.

Rebuilt equipment is usually guaranteed to perform as it did when new. The used equipment dealer through long contact with the process industries may recommend equipment for certain jobs, but, of course, cannot guarantee satisfactory application of the equipment as the original manufacturer may have done. In other words, he is not a consulting process engineer, but does endeavor to make the used machine perform as well as the original product. Minor revisions in design may provide the buyer with a custom job specially suited to his requirements.

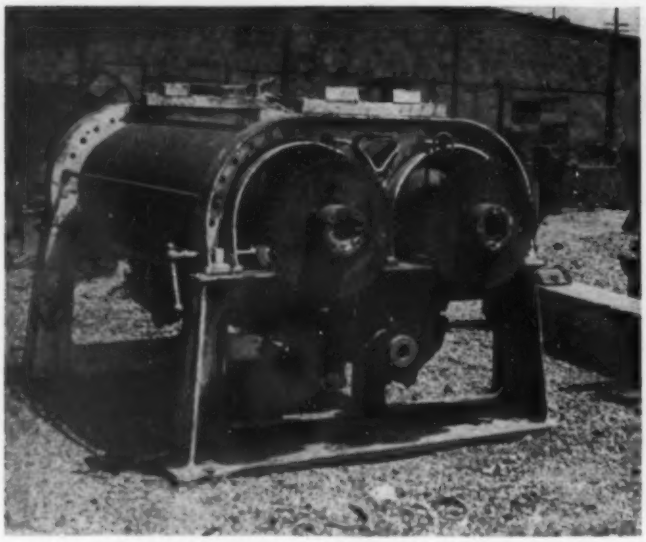
The reconditioning plant presents the usual outlay of tools and equipment which are necessary for quick efficient restoration of all types and sizes of process units. Caustic soda tanks are provided for dissolving grease or old product which may be adhering to the used parts. Sand-blasting and oxyacetylene burning equipment are also used. There are large and small lathes, radial drill presses, shapers and planers, hydraulic rams, grinders, huge cranes for heavy equipment, gas and arc welding outfits, metallizing guns and electrical testing meters. A few shops are also doing their own motor rebuilding. Every effort is made to keep up to date on new materials as well as new methods of repair. Types of equipment which are handled run all the way from ball mills, kettles and pumps to vacuum shelf dryers, bottling and labeling machines.

A typical example is a cracked Sweetland filter press which came into one shop. This presented a delicate job, for in making a pattern to cast this 12-ft. piece it was necessary to make an allowance for $1\frac{5}{8}$ in. shrinkage. The rough casting obtained from a nearby foundry was then accurately machined to fit the other section of the press.

When plate and frame presses are reconditioned, sand-blasting is an effective cleaning method. Sometimes the surfaces are badly corroded and then planing is necessary to insure smooth tight joints.

Vacuum pumps are thoroughly torn down and all necessary machine work done before reassembling. Single stage pumps are tested to a minimum of $28\frac{1}{2}$ in. and two stage pumps to $29\frac{1}{2}$ in., but will pull a higher vacuum

This jet condenser has a cracked casting which will be repaired by brazing



When a used double drum dryer comes into the plant it is completely dismantled and inspected before rebuilding is begun. Inspection may reveal that new driving shafts, gears, sprockets, V-belts, etc., are required

Approximately 80 percent of the bearings in dryers need new bronze bushings which are made from a piece of bronze stock by boring in a lathe as shown above. Fittings for proper lubrication must also be provided

than the minimum requirement. One rotary vacuum pump after rebuilding was tested to within 3 mm. of perfect vacuum. This particular pump, in addition to being completely overhauled, was mounted on a new base with V-belt drive, motor and slide rails.

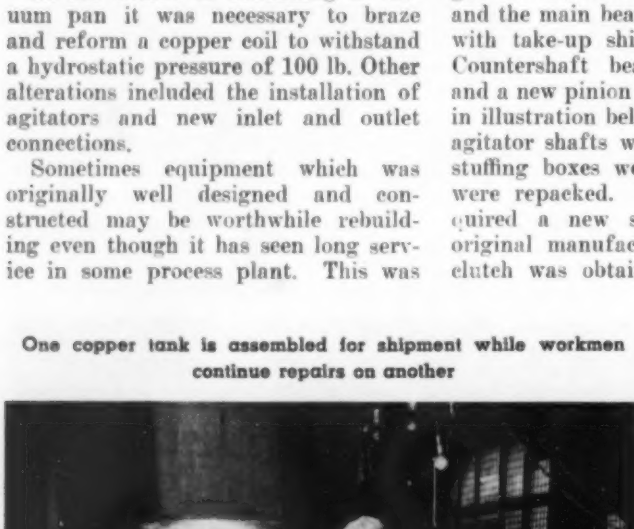
In the course of rebuilding a vacuum pan it was necessary to braze and reform a copper coil to withstand a hydrostatic pressure of 100 lb. Other alterations included the installation of agitators and new inlet and outlet connections.

Sometimes equipment which was originally well designed and constructed may be worthwhile rebuilding even though it has seen long service in some process plant. This was the case with one heavy duty mixer whose main drive shaft had to be replaced with an entirely new $3\frac{7}{16}$ in. shaft complete with keyway and key. (Equipment rebuilders generally use standard size shafts, bolts, etc. which make it easier to do further maintenance if and when required). New grooved bronze bushings were made and the main bearings were reinstalled with take-up shims and grease cups. Countershaft bearings were rebored and a new pinion gear installed (shown in illustration below). One of the two agitator shafts was replaced, two new stuffing boxes were made and glands were repacked. The chain drive required a new sprocket. From the original manufacturer a new friction clutch was obtained to complete the large replacements. With the rest of the parts carefully overhauled and guards installed around the gears, this mixer was thoroughly reconditioned and ready for long heavy duty service.

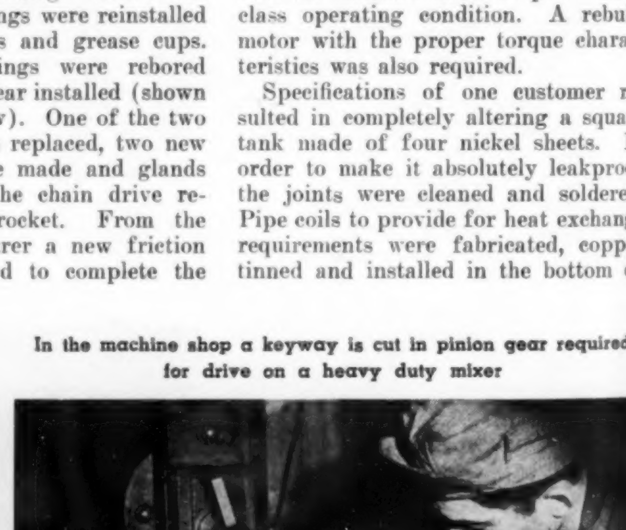
Inspection of a portable electric stacker indicated that the cable, brake and drive parts needed repairing before the machine could be put in first class operating condition. A rebuilt motor with the proper torque characteristics was also required.

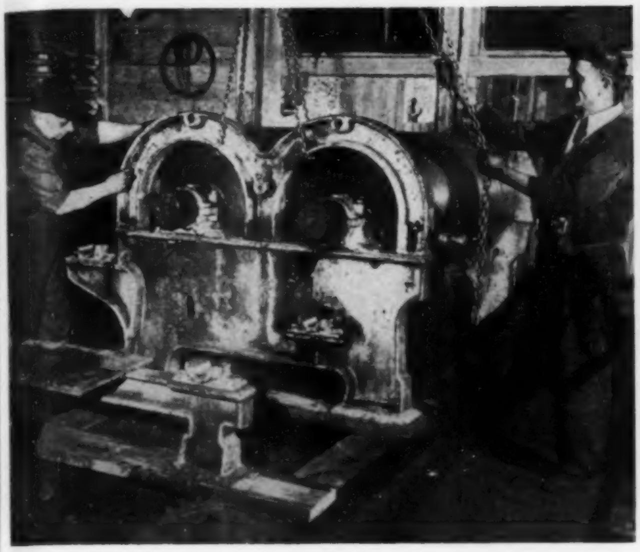
Specifications of one customer resulted in completely altering a square tank made of four nickel sheets. In order to make it absolutely leakproof the joints were cleaned and soldered. Pipe coils to provide for heat exchange requirements were fabricated, copper tinned and installed in the bottom of

One copper tank is assembled for shipment while workmen continue repairs on another

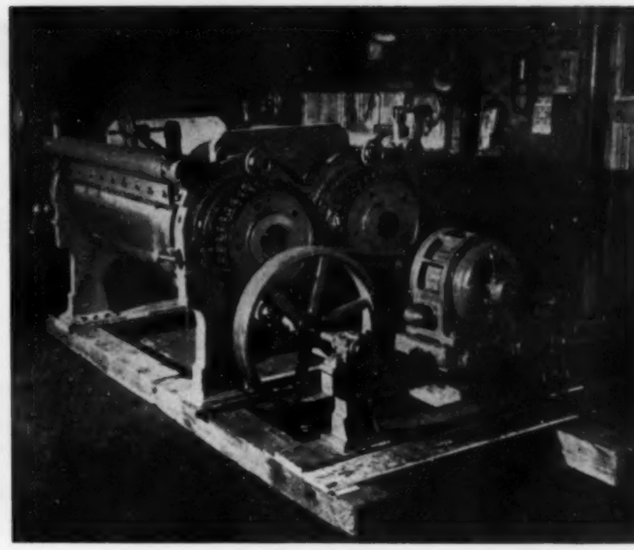


In the machine shop a keyway is cut in pinion gear required for drive on a heavy duty mixer





After cutting and grinding the rolls, they are reinstalled and miked to a clearance of 0.0015 in. This particular dryer required four new drum heads, but generally the original heads are satisfactory and are not replaced



Here the dryer is completely assembled and ready for shipment. The drums have been subjected to a hydrostatic pressure test of 120 lb., and the motor has been hooked up to permit inspection of the unit under operation

the tank. In this case the existing tank outlets did not have standard threads and were therefore replaced to facilitate piping connections. To complete the customer's specifications a thermometer well and a sight glass were installed.

The double drum dryer illustrated above was reconditioned to be used for drying yeast recovered from breweries. This type of equipment is particularly difficult to repair as its parts are large and heavy yet must be machined to close tolerances. Most of the smaller parts were replaced such as knife holders, knives, eccentrics for knife holders, end boards, end board wheels, screws, etc.

After the war is over, or when new plant equipment becomes available once more, the large chemical companies will probably revert to their policy of buying new equipment for their normal needs. However, a sizable market for the used machinery dealer will probably continue.

Most plant engineers prefer a better grade machine, even though somewhat used, to a less substantial new one. In some cases, therefore, where finances are limited, an engineer may turn to rebuilt equipment. Immediate delivery may furnish another good reason for consulting the second-hand dealer.

Temporarily increased production schedules sometimes find all the available units unable to carry the extra load. If the production is urgent and new equipment is too expensive to justify its purchase under the circumstances, a used machine may meet the requirements for the period.

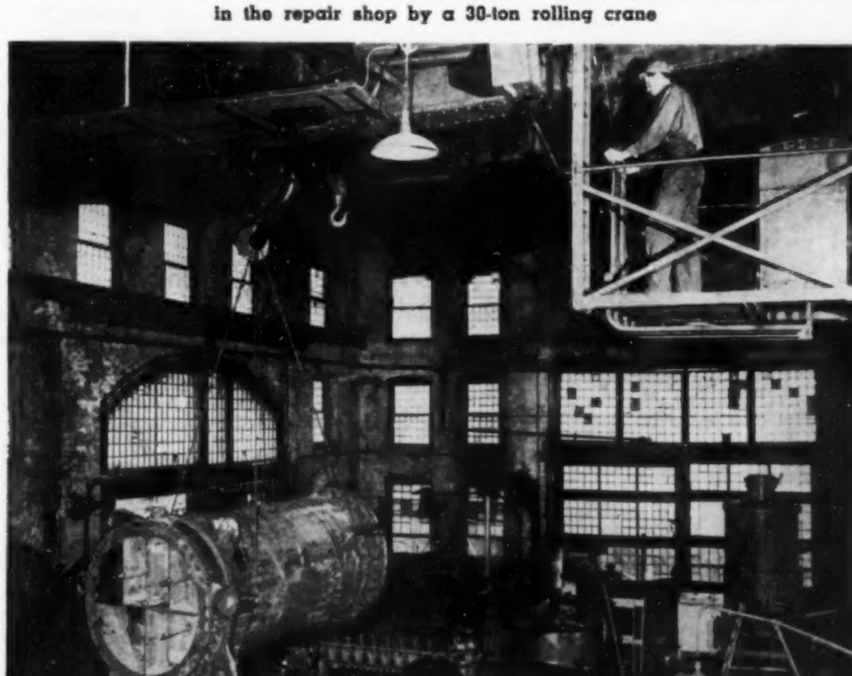
Engineering research men who have the responsibility of pilot plant research should find the used machinery market helpful in meeting their equipment needs. Often research groups are on a limited budget and cannot afford to purchase new plant-size units which may never produce for profits. Even if the equipment is to be used for scheduled production, it may only be infrequently operated, in which case a rebuilt unit might be the most economical choice.

Maintenance men in chemical process plants are already familiar with the used machinery dealer as a source of replacement items.

Some equipment rebuilders were making a few items of new plant equipment before the present emergency curtailed the amount of materials available for new construction. Perhaps this will be started again when the materials situation permits. At present, all the critical materials that can be obtained are going into the job of rebuilding used machinery, and all men and facilities are occupied to this end.

The writer gratefully acknowledges the cooperation given in the preparation of this material and illustrations by reputable used machinery dealers located in the greater New York area.

Heavy process equipment, such as this tubular heat exchanger, is easily handled in the repair shop by a 30-ton rolling crane



Modernizing Chemical Color Manufacture

JOHN R. CALLAHAM *Assistant Editor, Chemical & Metallurgical Engineering*

***Chem. & Met.* INTERPRETATION**

This is the story of how one progressive concern took over a typical, tank-burdened, batchwise dry color plant and proceeded to streamline processes and equipment to a remarkable degree. In fact, this plant only awaits the end of the war to put most of its operations on a continuous or semi-continuous basis. Believed to be the first such move in the industry, this will undoubtedly prove to be a major post-war development in the field of chemical color manufacture.—*Editors.*

MANUFACTURE of chemical colors is one of the oldest activities in the heavy chemical field, and the industry was flourishing in this country by the end of the 19th century. It was in the Germany of Bismarck, however, that production of Prussian blue and other inorganic dry colors first reached large-scale proportions. The early German pigment plants were full of colorful wooden tanks, small filter presses and drying ovens. All operations were batchwise, discontinuous, and inefficient. All processes were governed by guess and by rule-of-thumb. The master technicians of the times stirred and steamed and swore, hoping that the brew would somehow turn out a pigment acceptable to their customers, who were not yet quality-conscious.

This industry, such as it was, was introduced into this country. For the past half century improvements have been made in equipment and processes, but always slowly. The chemical pigment industry is still largely characterized by batch processes, discontinuous operations, batteries of wooden tanks and filter presses, multitudinous products and standards and an unscientific nomenclature. Rule-of-thumb methods and semi-controlled "arts" have been preserved by secrecy and confusion more than by patents. Research has largely been subordinated to short-term improvements rather than to broad advances. There has been progress, of course, but no revolutions in the field, and until very recently many color plants were still more like replicas of 19th century German chemical shops than 20th century American process efficiency.

STREAMLINING THE INDUSTRY

In recent years, however, progressive men in the field have begun to take a new and objective attitude toward accepted principles and practices. Efforts are now being made to streamline processes, reduce the number of standards, put nomenclature on a scientific basis, and to realign research to its only proper course.

Among the leaders of this movement for rejuvenation of the industry have been the engineers, chemists and executives of Reichhold Chemicals, Inc. These men were new to the pigment field, since it was only in 1938 that the large and venerable Fred L. Lavanburg Co. dry color plant in Brooklyn, N. Y., was acquired and became the Chemical Color Division of Reichhold Chemicals, Inc. The Lavanburg concern, founded in 1886 under the name of Pfeiffer & Lavanburg, had from the very first been a leader in the field and had pioneered in the manufacture of English vermilions and other chemical colors in this country.

Almost immediately, Reichhold research chemists and engineers began to improve processes by determining optimum conditions of temperature, pH, proportions, and other factors and by installing instruments for automatically recording and controlling these variables. Radical changes have already been incorporated into the processes and improvements are still being made.

Now, for almost four years, engineers at the Brooklyn plant have been streamlining equipment and layout that will eventually make most of the processes and operations continuous or semi-continuous. Although production is still batchwise, it is believed that this method of operation has been developed to its ultimate efficiency and that further efforts along this line would result in rapidly diminishing

Table I—Comparative Operating Data Showing Results of Streamlining Operations and Processes—Previous Practice Under Lavanburg as Compared to Present Practice Under Reichhold Chemicals, Inc.[1]

	Iron Blues		Chrome Greens		Chrome Yellows		Totals	
	Lavanburg	Reichhold	Lavanburg	Reichhold	Lavanburg	Reichhold	Lavanburg	Reichhold
Total pigment production, lb. per mo.	40,000	100,000	100,000	200,000	200,000	900,000	340,000	1,200,000
Making capacity, gal.	198,100	70,100	40,000	25,000	70,800	80,000	308,900	175,100
Number of tanks	32	5	10	1	23	5	65	11
Average capacity, gal. per tank	6,200	14,000	4,000	25,000	3,100	16,000	4,750	15,900
Pigment production, lb. per 1000 gal. per mo.	200	1,430	2,500	8,000	2,830	11,250	1,100	68,500
Producing space, sq. ft.	4,876	1,080	1,080	324	2,107	1,152	8,063	2,556
Pigment production, lb. per 100 sq. ft. per mo.	820	9,260	9,260	61,720	9,520	78,250	4,210	47,050
Man-hours per mo.	3,500	3,280	2,500	3,280	3,320	8,550	8,320	15,000
Pigment production, lb. per 1000 man-hr. per mo.	11,400	30,500	40,000	61,000	60,250	105,200	40,900	80,000

[1] Prepared especially for this article by H. B. Kirkpatrick, plant superintendent, Reichhold Chemicals, Inc., Brooklyn, N. Y. Similar improvements to those shown above have been made in facilities for producing organic pigments, but these figures have been omitted since they are difficult to put on a comparable basis.

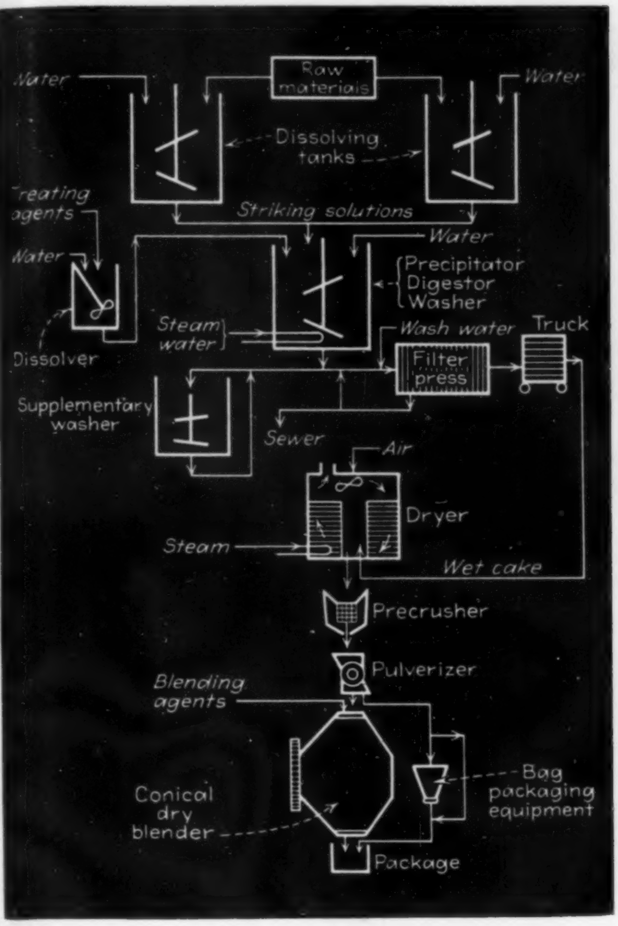


Fig. 1—This master equipment flow sheet shows present Reichhold practice in processing and handling dry colors

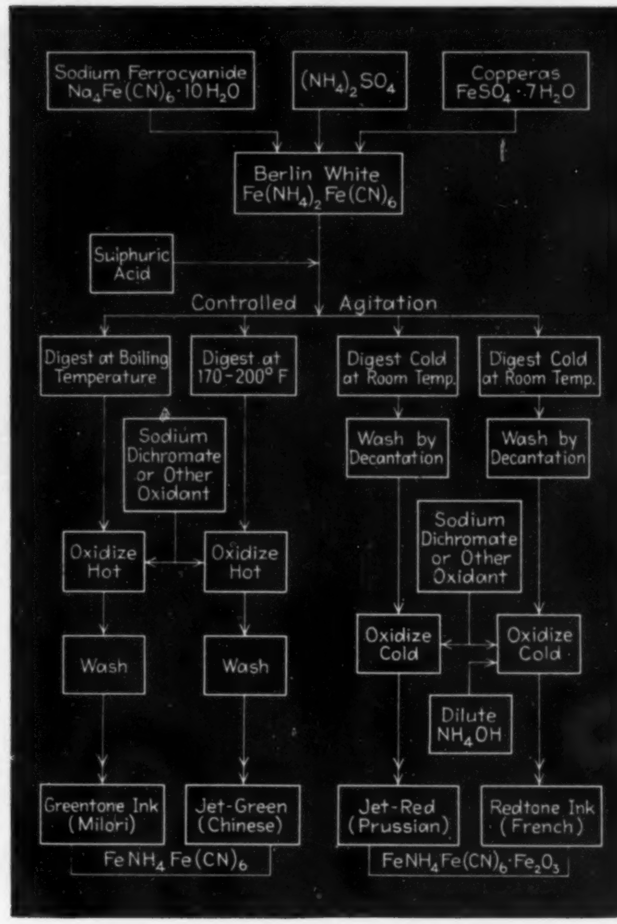


Fig. 2—Flow sheet showing Reichhold Chemical Co. operations for manufacture of the four basic types of iron blues

returns. In fact, all long-range planning of Reichhold engineers points to continuous operations. Indeed, actual methods of primary processing such as precipitation have already been largely reduced to a single basic principle and it can even now be said that all major processing problems involved in the conversion to continuous operations have been solved and that engineering work for such a change-over is now in the preliminary blue-print stage of development.

Results of these streamlining changes at the Brooklyn plant are shown very strikingly in the case of iron blues, chrome greens and chrome yellows by Table I, which gives operating data for these units under the old Lavanburg set-up as compared to the present Reichhold practice.

Pigments manufactured at Reichhold's Brooklyn plant include the chrome yellows and oranges, iron blues and chrome greens. These "Big Three" were industrially the most important of the inorganic dry colors until recently when zinc chromate, because of its usefulness in our aircraft and naval programs, assumed first place in tonnage and value. In addition to these inorganic colors, the Brooklyn plant also produces a large line of organic toners and lakes.

BASIC EQUIPMENT

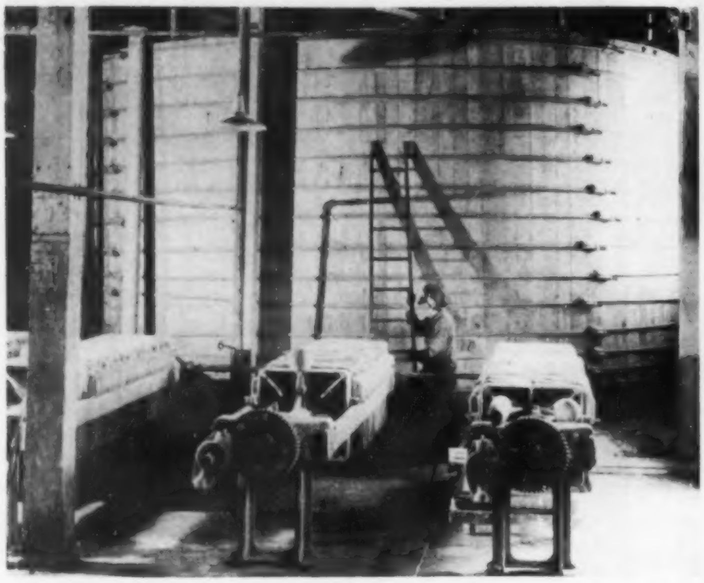
Basic equipment used in the manufacture of all the principal dry colors is fundamentally the same, although slight modifications in the processing procedure result in some changes in layout. However, because of the danger of color contamination, each of the basic pigments has a separate equipment set-up. Iron blues, for instance, are never made in equipment previously used for preparation of chrome yellows.

A master equipment flow sheet of the processes as now practiced in the Reichhold plant is shown in Fig. 1. The open dissolving or "striking" solution tanks are of wooden construction with two wooden cross blades and baffles on the sides for more effective agitation. These stirring devices, formerly all belt driven, are now direct gear drives. Here the basic raw materials are dissolved to a definite and controlled concentration with or without the aid of steam coils, and are then pumped at a controlled rate by centrifugal pumps of 200-300 gal. per min. capacity into another similar wooden tank of larger size where precipitation of the basic pigment occurs.

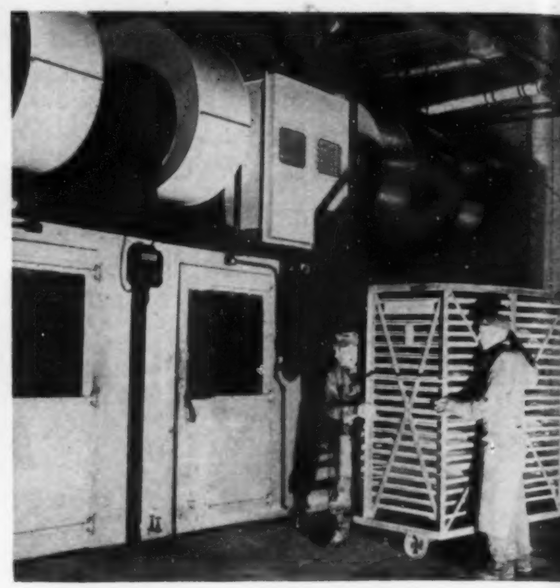
Size of the precipitators varies from a capacity of 6,700 gal. of slurry in the case of certain organic blues or purples to 40,000 gal. for zinc yellow. Single batch yields are 16,000 lb. of dry C. P. pigment for medium chrome yellow, 40,000 lb. for zinc yellow, 15,000 lb. for chrome greens, and 6,000 lb. for iron blues.

Treating agents, which may be acids or alkalis, oxidizing agents or other chemicals, are dissolved in small open tanks, usually lead-lined or acid resistant, and provided with a small high-speed, side impeller agitator. Small centrifugals pump the treating solutions into the precipitator at a predetermined rate and during agitation.

A major improvement in processing instituted by Reichhold engineers is that of accurate pH and temperature control throughout the precipitating and digesting steps. All production in each department is regulated from a single control panel equipped with multi-point pH and temperature control instruments. Flow rates of all solutions are controlled by flow meters and adjusted by valves located on the



This giant 40,000-gal. wooden tank, probably the largest ever built in the dry color industry, is used in producing zinc chromate pigment for aircraft and ship priming paints



Trucks of moist cake are here being wheeled into the dryers, where hot air circulates to reduce the moisture content to 1-2 percent within 20-30 hours

central panel. Drying temperatures are carefully controlled by automatic instruments equipped with dial and pointer adjustment. All dryer temperatures throughout the plant are continuously recorded on a single multipoint temperature recorder of the continuous roll type located in the laboratory.

MATERIALS HANDLING

After color precipitation, digestion and washing by decantation, the slurry is pumped into batteries of wooden plate-and-frame filter presses, each about 10 ft. long and having 40 plates. Heavy cotton canvas is used as the filtering medium. The batteries, one for each basic pigment, contain from 10 to 20 individual presses. Cakes of about 1.5 in. are built up and then washed free of soluble salts by water.

Throughout the steps of precipitation as well as digestion and washing, processing conditions for the basic colors and for some of the different shades all differ, for it is in these phases that the fundamental characteristics of the pigment are developed. These variations in processing are discussed briefly in a later section. However, handling operations which involve filtering, drying, pulverizing, blending and packaging are fundamentally the same for all products, so that the following paragraphs may be applied equally well to iron blues, chrome yellows and oranges, chrome greens, zinc chromate and organics.

Filter presses are opened by hand, the cakes of wet pigment placed in shallow aluminum or enameled steel trays and loaded on small frame trucks about 6×5×2.5 ft. equipped with wheels. Each truck holds 40 trays with an air space of about 3 in. between trays. These are pushed by hand to a battery of centrifugal fan-type dryers, each of which holds six such trucks, or the cakes from six filter presses. Here air, heated to 185 - 212 deg. F. by steam coils, is circulated until the moisture content of the cakes is reduced to the neighborhood of 1.0-2.0 percent, a process usually requiring some 20-30 hours. Huge centrifugal fans exhaust the moist air, while control instruments record temperatures.

The trucks of dried colors are returned to an upper floor where the trays are dumped into pre-crushers provided with exhaust hoods, where lumps are broken up. The material is then fed into high-speed (6,000 r.p.m.) hammer mills of the Micro-pulverizer type. These are run by squirrel-cage motors and charge large conical blenders located on the floor below. Some of these mills are portable and can easily be moved to feed more than one conical blender. There are three such mill rooms, one for organic reds, another for the greens, blues and purples, while the third is used for the chrome yellows and oranges.

All material is ground to pass 100 percent through a 325-mesh screen. Some materials which do not require blending are pre-crushed into the hoppers on the ground floor directly into barrels or other containers.

If, after grinding, a batch is slightly off shade or if other materials are to be blended in, the pigment is charged into one of the two double-cone mixers rotated on trunnions, as shown in an accompanying illustration, and provided with a magnetic brake mechanism. Thorough mixing is usually attained within 15-20 min., and power consumption seldom exceeds 1.5 hp. per 1,000 lb. of charge. Blenders vary in capacity from 2,500-10,000 lb. of dry color. For special blends, a double-helical ribbon mixer is provided. Zinc chromate, now a major part of Reichhold's pigment production, is for the most part packaged in multiwall paper bags from bag packing equipment.

IRON BLUES

Iron blue pigments fall naturally into four separate general classifications, depending upon their outstanding shade characteristics. These classes with the old nomenclature and that introduced by Reichhold technicians are given in Table II. Fig. 2, modified after that by Brown*, shows the principal steps in manufacturing these pigments as practiced at the Brooklyn plant.

All basic iron blues are obtained from sodium ferrocyanide, ammonium sulphate and ferrous sulphate raw materials with sulphuric acid and an oxidizing material as treating agents. They are all alike in that the white base or ferrous ammonium ferrocyanide (often called Berlin white) is precipitated by mixing dilute solutions of sodium ferrocyanide and ammonium sulphate with a solution of copperas. Actually, it makes little difference which solution is run into the other.

* This description of iron blue manufacture is based to a large extent upon the article by T. P. Brown, *American Ink Maker*, p. 23–26, 43, Dec. 1939. An excellent discussion of the nomenclature of dry colors and proposed improvements has been given by H. B. Kirkpatrick, p. 47–49, 53 of the Sept. 1939 issue of the same magazine.

It is very important that the ferrous sulphate and other materials be free of ferric salts, otherwise a very hard, crystalline product without pigment properties will be formed. The basic reaction for the formation of the pure white base is as follows:

$$Na_4Fe(CN)_6 \cdot 10H_2O + FeSO_4 \cdot 7H_2O + (NH_4)_2SO_4 \longrightarrow Fe(NH_4)_2Fe(CN)_6 + 2Na_2SO_4 + 17H_2O$$

At this stage the relative amount of ammonium sulphate, concentration of striking solutions, temperature of reaction and rate of agitation are all important in determining the quality of the final product. For instance, when Prussian or Jet-Red blue is desired, the temperature of the reactants is held to about 70-100 deg. F. Reichhold chemists have done much work on determining the effect of each of these factors, as a result of which numerous control devices have been installed to guarantee absolute uniformity in quality of the final pigment.

After precipitation of the white base an acid, usually sulphuric, is added. The amount of acid determines to a large extent the texture and oil absorption of the final product.

At this point it is well to remember that the basic iron blues can be divided into two broad classifications: the green-shade blues and the red-shade blues. The shade of the product will depend primarily upon the conditions in the digesting, oxidizing and washing steps, variations of which are shown in Fig. 2. The one fundamental difference in treatment is that while the green shades are digested hot and oxidized before washing, the red shades are digested cold and washed by decantation before oxidation. Since oxidation releases ferrous sulphate which is retained as a ferric oxide if washing is conducted after oxidation, the red shades retain this iron oxide and as a result have a characteristic tint.

In the case of Greentone Ink blue (Milori), the acidified white base is boiled for several hours, after which an oxidizing agent such as sodium dichromate or chlorate is added to convert the Berlin white base to the ferric condition:

$$Fe(NH_4)_2Fe(CN)_6 \longrightarrow FeNH_4Fe(CN)_6$$

The color is now washed several times by decantation, filtered, the cake washed in the presses, and finally dried by hot air.

The essential differences in processing Greentone Ink blue and Jet-Green blue are that in the latter more ammonium salt is used and digestion temperature is lower, being held at 170-200 deg. F. instead of at a boil. Alteration of the acidity, concentrations, temperature and time of oxidation all cause variations in the shade of blue secured.

Jet-Red and Redtone Ink blues (Prussian and French) differ from the green-shade blues in that they receive less, and in some cases no heat treatment. They are also oxidized after washing by decantation to a very low acid concentration rather than in the hot, strongly acid state. Thus the ferrous sulphate oxidation product is retained in the blue molecule as ferric oxide to give a red tint. Usually ammonia is added to the slurry before it is filtered in order to increase the redness of tone. In general, Jet-Red may be made in the same manner as the Redtone Ink except that the amount of ammonium sulphate during precipitation of the base white is increased considerably.

Table II—Nomenclature and Composition of C.P. Iron Blues

New Descriptive Name	Historical Name	Composition	Formula
Greentone Ink	Milori	ferric amm. ferrocyanide	$FeNH_4Fe(CN)_6$
Jet-Green	Chinese	ferric amm. ferrocyanide	$FeNH_4Fe(CN)_6$
Redtone Ink	French	basic ferric amm. ferrocyanide	$FeNH_4Fe(CN)_6.nFe_2O$
Jet-Red	Prussian	basic ferric amm. ferrocyanide	$FeNH_4Fe(CN)_6.nFe_2O$

Yields of iron blues on the basis of sodium ferrocyanide vary considerably, being highest in the red shades since these contain varying amounts of red ferric oxide or hydrate and lowest in the green tones. Yields of the red-shade blues may go up to 80 percent of the sodium ferrocyanide raw material, while those of the green shades rarely surpass 65 percent and may often be as low as 60 percent. Thus 155-210 lb. of sodium ferrocyanide (decahydrate) and 75 lb. of copperas may be required to produce 100 lb. of dry iron blue pigment.

Reichhold also produces a potash blue at its Brooklyn plant. This pigment, restricted in its use because of its higher cost, is made more or less in the same manner as the soda-ammonium varieties already described except that the primary raw material is potassium ferrocyanide and the use of ammonium sulphate is unnecessary.

CHROME YELLOWS

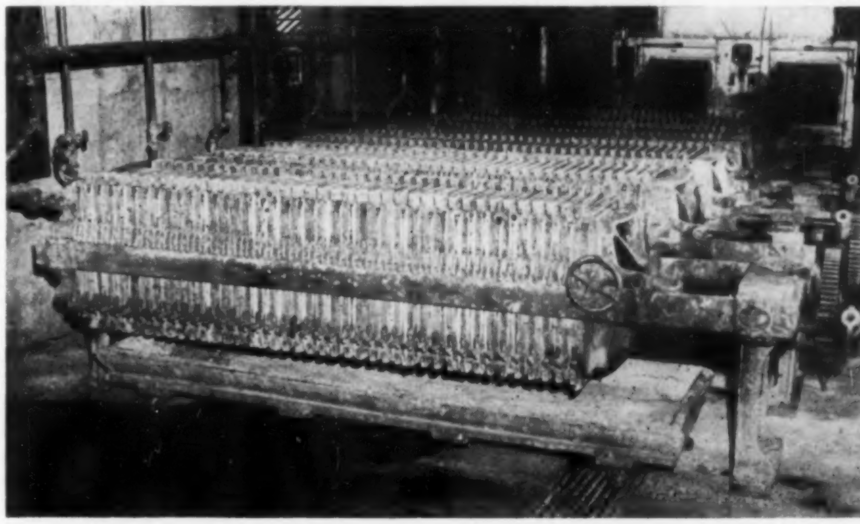
Chrome yellows fall into three classes, according to redness of tone, as follows: Primrose, Light and Medium. The Medium shade approaches pure normal lead chromate in composition, whereas the Primrose and Light types consist of lead sulphate in combination with lead chromate in mixed crystals or solid solution. Approximate composition of the three types of chrome yellows are given in Table III. This class of pigments normally represents Reichhold's largest color tonnage.

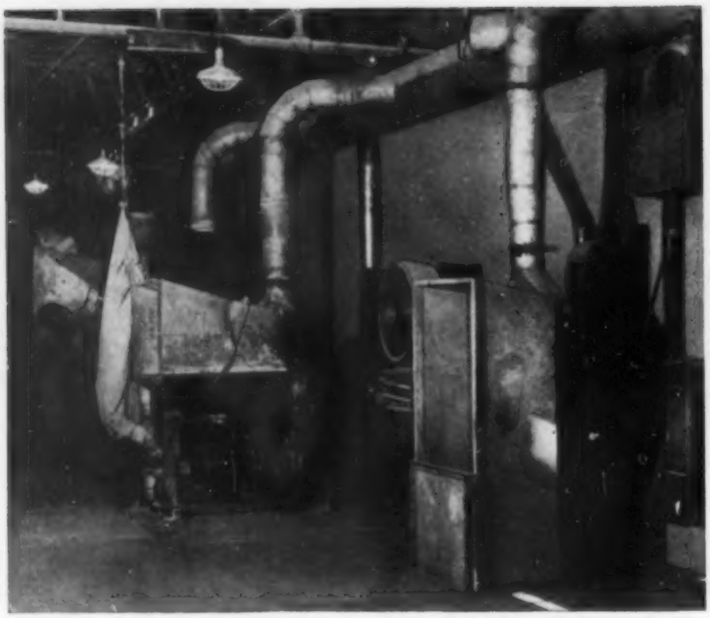
Basic raw materials used in chrome yellow manufacture are litharge, bichromate of soda and nitric, acetic and sulphuric acids. Relatively small quantities of other acids and metallic salts are used for crystal fixation and to impart special properties to individual products.

Generally, a solution of litharge in dilute nitric or acetic acid is made up in a 10,000-gal. reaction tank equipped with a direct-drive double crossblade agitator. Bichromate of soda solution, containing the amount of sulphuric acid required for the shade of product being made, is then added at a controlled rate. Throughout the operation, the pH of the slurry is controlled by addition of small amounts of acid or alkali as required. In general, an increase in the pH increases the redness of color of the final product. Thus, chrome yellow Medium is always formed under less acid conditions than the other two shades.

The crystal form of Primrose yellow is rhombic, an unstable pale form which is fixed by precipitation with a small amount of aluminum hydroxide and/or phosphate. This prevents recrystallization to the stable monoclinic form, which would result in profound changes in color shade and other properties. Both the Primrose and Light yellows are always formed at 70-80 deg. F. in the presence of excess soluble lead, since in a medium containing excess soluble

Such batteries of wooden plate-and-frame filter presses can turn out every month over 600 tons of iron blues, chrome greens and chrome yellows at the Reichhold dry color plant in Brooklyn. Four years of streamlining has increased productive capacity almost four-fold and has reduced floor space, equipment and labor costs





The trays of dried colors are dumped into pre-crushers, after which the material is fed to hammer mills of 6,000 r.p.m. The Reichhold plant has three such mill rooms for different colors

Double-cone mixers like this can blend other inert agents into the pure pigment to produce 2,500–10,000 lb. of "reduced" color for each blending operation

chromate the color develops instantaneously into the darker monoclinic crystal form.

Light yellow is also precipitated as rhombic crystals of a pale yellow shade. However, no fixing agents are added to this, so that upon digestion and washing by decantation the crystal passes to the monoclinic form and the color develops to a rich, lemon shade, high in tinctorial strength and possessing superior lightfastness. This shade contains about 30 percent of lead sulphate coprecipitate as compared to about 50 percent for the Primrose grade.

Chrome yellow Medium forms directly as the golden monoclinic crystals which are characteristic of pure or nearly pure normal lead chromate. Therefore, this type may be made either by addition of lead solution to chromate solution or by the reverse addition and the precipitation temperature may range up to 120 deg. F. No crystal fixatives are required for this shade. Precise pH control and vigorous agitation are necessary to produce a uniformly high quality of product for the pigment trade.

CHROME ORANGES

Chrome oranges are basic lead chromates as contrasted to chrome yellows, which are normal lead chromate or lead sulpho-chromate. The empirical formula of chrome oranges is $PbCrO_4 \cdot nPbO$, in which n varies from 0.5 for the extra light shade to 1.5 for the very deep shade, sometimes known as chrome red. Thus the following series can be developed:

Primrose chrome yellow.... $PbCrO_4 \cdot PbSO_4$
Medium chrome yellow........... $PbCrO_4$
Extra light chrome orange $PbCrO_4 \cdot 0.5\ PbO$
Extra deep chrome orange $PbCrO_4 \cdot 1.5\ PbO$

Both equipment and processes used for the manufacture of chrome yellows and oranges are similar in the Reichhold plant. The chief difference lies in the fact that the chrome oranges are precipitated in hot alkaline medium and are boiled after precipitation for complete development of brilliant reddish shades. As in the case of Medium chrome yellow, it matters little whether the soluble lead salt used is the nitrate or acetate, though the latter is more generally used by Reichhold because of its greater availability.

Chrome oranges are made in 10,000-gal. precipitating tanks at the Brooklyn plant. To a concentrated solution of sodium dichromate in the making vat, caustic soda is added until the desired alkalinity is obtained, which varies from pH of 7.0-10.0 and is dependent upon the shade being produced. Hot, dilute lead solution is then run in at a controlled flow rate, after which the slurry is digested at a boil for 5-10 min., the darker shades requiring the longer digestion period.

Table III—Nomenclature and Composition of C.P. Chrome Yellows

Commercial Name	Shade	Approximate Percentage Composition: Lead Chromate	Lead Sulphate	Other Lead Salts
Primrose...	pale.....	45	50	5
Light......	lemon....	67	33	..
Medium....	golden...	98	..	2

CHROME GREENS

In the paint industry, chrome green is more extensively used than any other green pigment. The generic term applies to an intimate physical mixture of chrome yellow and iron blue produced by precipitation of lead chromate or lead sulpho-chromate in an aqueous medium containing finely dispersed green-shade iron blue.

Reichhold produces three basic types of chrome greens, each in a wide range of shades, varying in blue content from 3-50 percent. First and most important because of their great brilliance, opacity, hiding power and permanence, come the Nitrate greens, so called because lead nitrate is used in their manufacture. When reduced with white, these yield a very bluish tint, and for this reason are sometimes called "blue-tint" greens.

Acetate chrome greens made, as the name implies, with lead acetate are less brilliant and considerably more transparent than the Nitrates and for equal depth of masstone reduce with white to a much yellower tint. Nomenclature and approximate composition of the blue-tint (Ferndale) and the yellow-tint (Neptune) greens are given in Table IV.

The chrome yellow constituent of both the Acetate and Nitrate greens is similar in manufacturing process, chemical composition and general properties to chrome yellow Primrose, but with somewhat less sulphate than is generally con-

Table IV—Nomenclature and Composition of C.P. Chrome Greens (Iron Blue—Chrome Yellow Co-Precipitates)

Commercial Name	Approximate Percentage Composition: Ferric Ferrocyanide	Lead Sulphate	Lead Chromate
Blue Tint or Ferndale Greens			
Light........	24	10	66
Medium......	31	9	60
Dark........	36	8	56
Yellow Tint or Neptune Greens			
Extra Light..	8	88	4[1]
Light..... ..	18	2	80
Medium.... ..	27	3	70
Dark..... .	47	3	50

[1] Lead tartrate.

tained in the latter. As in Primrose yellow, these greens are always formed in an excess of soluble lead, and are "fixed" by formation of aluminum hydroxide and/or phosphate in the green slurry.

The third series produced by Reichhold is the Olive greens, so called because of their characteristic olive-drab cast in full tone. The yellow counterpart of the Olive greens is Medium chrome yellow. The process for making Olive green is similar to that for the Medium yellow except, of course, that finely divided iron blue is added to the lead solution for making the green.

Reichhold greens are produced in 25,000-gal. precipitating tanks, which are probably the largest units ever employed in this country in green manufacture. Each batch yields about 10,000 lb. of dry C.P. pigment.

ZINC CHROMATE

For many years zinc chromate, a pale yellow approximating the shade of chrome yellow Primrose in full tone, was used to a limited extent in combination with iron blue for making very clean, permanent greens. In recent years, however, it has gained wide prominence as a rust inhibitive pigment for metal priming paints, and is now used in large quantities by the Army and Navy for aircraft and ship primers. In its contribution to the war effort, zinc chromate stands as the most important single pigment produced today.

Commercial zinc chromate is actually a zinc-potassium-chromate complex salt of the empirical formula $5ZnO \cdot 4CrO_3 \cdot K_2O \cdot 3H_2O$. It is slightly soluble in water, the readily available chromate ions exerting a retardant effect upon formation of metal oxides. Reichhold manufactures two types of zinc chromate, the common sulphate-containing variety and a new type entirely free of sulphates.

Raw materials used in the manufacture of zinc chromate are zinc oxide, bichromate of potash and sulphuric acid. One of the most important quality control factors is the type of zinc oxide employed. This must be carefully controlled for particle size and distribution as well as for chemical reactivity.

The manufacturing process commonly consists of slurrying zinc oxide in water, addition of potassium bichromate solution and subsequent acidification with sulphuric acid to a pH of 6.0-6.5. Concentration of reactants, rate of agitation, temperature, and reaction times must be very accurately controlled. After pressing in recessed-plate iron filter presses, the pigment is dried at 175 deg. F. for 36 hours to a free moisture content of 0.1 percent. It is then pulverized and packaged in multiwall paper bags.

Zinc chromate is produced at the Brooklyn plant in a giant 40,000-gal. reaction tank. Here, as also in the case of the other inorganic dry colors, the plant engineers believe that the upper practical limit for a batchwise process has been reached. Laboratory work is now in process to develop continuous processes and the end of the war will undoubtedly see final development of these to a plant scale.

ORGANIC PIGMENTS

Nomenclature of organic pigments has been somewhat ambiguous in the past and this difficulty persists in many quarters today. Table V gives one convenient form of classification. However, a logical analysis of this problem based on the chemistry involved permits a definition of terms entirely without contradiction. Thus "toner" will refer to any organic pigment not reduced in strength with an inert extender. "Lake" will refer to a pigment resulting from precipitation of a soluble dye which has been adsorbed by and at least *partially combined chemically* with a suitable "active" extender.

This criterion of partial combination thus eliminates from the category of "lakes" such a pigment as results from precipitation of methyl violet by phosphotungstic acid in the presence of alumina hydrate. This pigment is simply a "reduced toner" because basic dyes do not *combine* with alumina hydrate but are only adsorbed by it. Of course it is possible to have both reduced toners and reduced lakes.

By far the largest proportion of organic pigments are of the azo type. This makes the chemical reactions involved in the preparation of the azo structure the most important ones in the technology of organic pigments. In brief, this process involves the following steps:

(1) Preparation at a low temperature of a diazonium salt by the reaction of nitrous acid on a water solution of the mineral acid salt (usually the hydrochloride) of a primary aryl amine. The nitrous acid is normally prepared in place from sodium nitrite and excess mineral acid.

(2) Coupling of the diazonium salt with a phenolic substance (e.g. B-naphthol) to produce the coloring matter containing the azo group.

In the case of pigment dyestuffs (refer to Table V), the colored compound happens to be insoluble in water and in oils and differs widely in index of refraction from the usual paint and printing ink vehicles, thus giving it pigment properties.

In the case of salt type pigments, the products may be the metal salts (usually alkaline earth metals or lead) of acid dyestuffs, or the heteropoly acid salts (phosphotungstic, phosphomolybdic or mixtures) or other acid salts (silicic, tannic, arsenic, antimonic) of basis dyestuffs.

The newest group of pigments or that which contains the coordinated complexes, involves a different technology. Phthalocyanines are formed only at elevated temperatures (about 500 deg. F) and hence the process for their manufacture involves non-aqueous fusion. However, Para Brown, which is chemically a member of this group, may be prepared in aqueous medium. It is the copper coordination complex of Para Red.

Factors governing the quality of the products obtained have long been well known. They include the concentration, temperature, and acidity of the reacting solutions; rate of precipitation and crystal formation of the product; ionic environment during the actual color formation; relative vigor of the agitation used; and drying temperature.

More important, however, are the means taken to ensure adequate reproducibility of the values of these factors, especially when the unit batch size may be four to ten times that usually prepared in the dry color industry. The value of such a single batch may approach \$5,000 and hence exceptional precautions must be taken to ensure its quality. This modern plant in Brooklyn uses for this purpose many devices not heretofore widely used in the industry, such as liquid flow meters, matched delivery pumps, multiple station centralized pH control and recording, accurate recording thermometers, and constant speed stirring mechanisms.

In conclusion, the writer would like to express appreciation for the aid extended by Reichhold Chemicals, Inc. and specifically by Mr. H. B. Kirkpatrick, superintendent of the Brooklyn plant, Mr. T. P. Brown, general manager of the Chemical Color Division and director of the Eastern Research Division, and Mr. P. L. Swisher, sales manager of the company. This concern and its individuals have consistently shown a broad-minded and progressive attitude and a cooperative spirit in the development of this information and manuscript.

Table V—Classification of Organic Pigments

	Examples
Pigment Dyestuffs	
Azo type	Paratoner, Toluidine toner
Vat, sulphur, thioindigo, etc.	Indanthrene Blue
Salt Type Pigments	
Toners	
(1) Of acid dyestuffs	
Azo type	Lithol toners, Red Lake C
Triphenyl methane derivatives	Phloxine toners
Others	Various
(2) Of basic dyestuffs	Heteropoly acid salts of Methyl Violet, Victoria Blue
Lakes (acid dyestuffs only)	
(1) Of azo dyes	Persian Orange, Acid Scarlet
(2) Of triphenyl methane derivatives	Peacock Blue
(3) Of anthraquinone dyes	Madder Lake
(4) Others	Various
Coordinated Complexes	Phthalocyanines, Para Brown

Chemical Industries Branch, O.P.R.D. What It is and How It Functions

DONALD B. KEYES, *Chief of the Chemical Industries Branch, Office of Production Research and Development, W.P.B.*

Chem. & Met. INTERPRETATION

What has been aptly called the Research and Development Department of the War Production Board is outlined here as to purpose, functions and personnel. Within a matter of months O.P.R.D. has become an extremely useful agency for bringing a fuller impact of science and technology to bear on the problems of war industries. Chemical engineers and executives are urged to make more use of the facilities and personnel of its Chemical Industries Branch.—*Editors.*

BROADLY SPEAKING, the purpose of the Office of Production Research and Development is the mobilization of our technological personnel and facilities for the production of war goods. Its functions are distinct from those of the Office of Scientific Research and Development which is charged with the improvement of the actual instrumentalities of war. O.P.R.D.'s primary concern is with the maximum production of needed critical materials. Its field embraces all war materials, both crude and processed, with the exception of synthetic rubber which is handled by W.P.B.'s Office of the Rubber Director.

O.P.R.D. is headed by Dr. Harvey N. Davis, president of Stevens Institute of Technology. It consists of a director, his staff and four branches: (1) Metals and Minerals, (2) Chemical Industries, (3) Industrial Processes and Products, and (4) Consumer Products. The Chemical Industries Branch consists of its chief and the headquarters staff in Washington, approximately forty official consultants who are chiefly $1-a-year men, about 160 liaison men who are mostly industrial research directors designated by their companies as O.P.R.D. contacts, and, finally, many unofficial consultants connected with other governmental agencies in Washington. (Personnel roster given here is as of June 1.)

The Referee Board, organized last summer by the Chemical Division of the W.P.B., (See *Chem. & Met.*, Aug. 1942, p. 129) now acts as the Chemical Referee Board for O.P.R.D. This group of 14 impartial scientists and engineers meets once a month and prepares opinions on the granting of money and priorities on specific projects brought to its attention by the investigators in Washington.

The main function of the Chemical Industries Branch is to evaluate developments and make recommendations for the allocation of O.P.R.D. funds or the giving of necessary priorities by the W.P.B. for specific projects. Emphasis is placed on the war demands for the end products and the speed with which a commercial plant can be built and put in operation. The amount of critical material required for plant construction per pound of product is the chief criterion.

Requests for these evaluations come largely from the Chemical Division, W.P.B., but many come from corporations, individuals and other governmental agencies, such as the Defense Plant Corporation, the Smaller War Plants Corporation, and technical groups within the armed services.

Sometimes it has been felt justifiable to encourage the building of large pilot plants or even small commercial units to produce chemicals which are not badly needed at the moment but will be needed in case of a long war. Such "insurance-policy" unit plants will provide the necessary engineering

Based in part on an address to the American Institute of Chemical Engineers in New York City, May 10, 1943.

Who's Who in Chemical Industries Branch, O.P.R.D.

Washington Headquarters Staff

Donald B. Keyes, Chief
W. L. Faith
L. A. Monroe
J. E. Underwood
J. P. Wilkins

Consultants Including Referee Board

Baldwin, Ira L., Madison, Wis. (Fermentologist)
Boelter, L. M. K., Berkeley, Cal. (Chemical Engineer)
Bogert, Marston T., New York, N. Y. (Consulting Organic Chemist; Referee Board)
Brown, Charles O., New York, N. Y. (Chemical Engineer; Referee Board)
Daniels, Farrington, Madison, Wis. (Physical Chemist)
Downs, Charles R., New York, N. Y. (Consulting Chemical Engineer; Referee Board)
Elder, Albert L., Washington, D. C. (Chemist, Liaison with Chem. Division, W.P.B.)
Esselen, Gustavus J., Boston, Mass. (Consulting Chemist; Referee Board)
Falk, K. George, New York, N. Y. (Chemist; Biologist)
Fulmer, Ellis I., Ames, Iowa (Chemist)
Glockler, George, Iowa City, Ia. (Physical Chemist)
Halvorsen, H. Orin, St. Paul, Minn. (Bacteriologist)
Hasche, R. L., Kingsport, Tenn. (Chemical Engineer)
Hildebrand, Joel H., Berkeley, Cal. (Chemist; Referee Board)
Hougen, Olaf A., Madison, Wis. (Chemical Engineer)
Killeffer, David H., New York, N. Y. (Chemist; Editor)
Kirkpatrick, Sidney D., New York, N. Y. (Chemical Engineer; Referee Board)
Langdon, Wm. H., Urbana, Ill. (Chemical Engineer)
Lawson, George, New York, N. Y. (Chemist; part time in Washington)
Lewis, Warren K., Cambridge, Mass. (Chemical Engineer; Referee Board)
Lind, S. C., Minneapolis, Minn. (Chemist; Referee Board)
Miner, Carl S., Chicago, Ill. (Consulting Chemist; Referee Board)
Moore, Wm. C., New York, N. Y. (Chemist; part time in Washington)
Nelson, John M., New York, N. Y. (Organic Chemist)
O'Brien, Morrough, Berkeley, Calif. (Mechanical Engineer)
Othmer, Donald F., Brooklyn, N. Y. (Chemical Engineer)
Perry, John H., Wilmington, Del. (Chemical Engineer; part time in Washington)
Read, Wm. T., New Brunswick, N. J. (Chemist; part time in Washington)
Reid, Ernest W., Macksville, Kan. (Chemist, Referee Board)
Rhodes, Fred H., Ithaca, N. Y. (Chemical Engineer; Referee Board)
Shreve, R. Norris, W. Lafayette, Ind. (Chemical Engineer)
Snell, Foster D., Brooklyn N. Y. (Consulting Chemist; Referee Board)
Stark, Wm. H., Arroya, P. R. (Fermentologist)
Straub, Frederick G., Urbana, Ill. (Chemical Engineer)
Sullivan, Frederick W., Chicago, Ill. (Chemist)
Swann, Sherlock, Jr., Urbana, Ill. (Electrochemist)
Sweeney, Orlando R., Ames, Ia. (Chemical Engineer)
Tour, Reuben S., Cincinnati, O. (Chemical Engineer)
Tyler, Stephen L., New York, N. Y. (Chemical Engineer)
Watson, Kenneth M., Madison, Wis. (Chemical Engineer)
Wilson, Wm. Courtney, Chicago, Ill. (Containers Expert)
Whitmore, Frank C., State College, Pa. (Organic Chemist; Referee Board)
Werkman, Chester H. Ames, Ia. (Biochemist)
Wynd, Clarence L. A. Rochester, N. Y. (Chemical Engineer; part time in Washington)

data and experience to construct quickly any needed number of commercial units.

Requests for funds for research and development usually come from university laboratories which do not have money available for such purposes or from industrial laboratories which have been specifically asked to undertake certain work purely of war-time significance. In such cases the project may have been already evaluated and it is a question of locating the organization or organizations best equipped to carry on the work and obtain results in a minimum time.

These investigations involve conferences with the project advocates, inspection of laboratories, review of patent and other literature, conferences with consultants and telephone conversations with liaison men. When the study has been completed the final report together with supporting data is sent to the Chemical Referee Board for consideration at its next monthly meeting. The Board's recommendation is sent to the Chemicals Division of W.P.B. If it is an approval of priorities, then the action of the Referee Board together with the approval of the Chemical Division of W.P.B. is passed on to the Facilities Review Committee for final approval. In urgent cases this procedure can be substantially shortened by telephone or telegraph vote of the Referee Board.

The Chemical Industries Branch has few specific problems for assignment but will welcome the opportunity to consider any new process to make any chemical badly needed in our war program, particularly if the new process does not require excessive amounts of critical materials and equipment for plant construction. The branch would also welcome any knowledge of either new or old products that can be made easily available and which may be used as substitutes for very critical materials. Examples of new processes already considered by the branch are as follows: acetylene from hydrocarbons, formaldehyde from hydrocarbons, benzene from petroleum, nonelectrolytic chlorine processes, low-pressure fixation of nitrogen, hydrolysis of wood, ethyl alcohol from wheat, glycerine by fermentation of molasses, and gasoline additives.

O. P. R. D. Liaison Men in Chemical Industries

Abbott Laboratories
Ernest H. Volwiler
Air Reduction Co.
Floyd J. Metzger
Allied Chemical and Dye Corp.
Solvay Process Co.
Joseph M. Braham
Paul A. Keene
Bates Torrey
Barrett Division
S. P. Miller
General Chemical Co.
John Donleavy
National Aniline Division
Walter M. Ralph
Alox Corp.
D. F. Evans
Aluminum Company of America
Francis C. Frary
Junius D. Edwards
American Cyanamid Co.
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Norman A. Shepard
Louis C. Jones
M. L. Crossley
American Potash and Chemical Corp.
Frank R. Bridgeford
American Viscose Corp.
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Armour and Co.
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Edmund Claxton
Atlantic Refining Co.
H. W. Field
Richard B. Chillas, Jr.
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W. E. Fletcher
Badger and Sons Co., E. B.
Elwood I. Clapp
Joseph R. Minevitch
George P. Lunt
Bakelite Corp.
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Robert J. Moore
Bancroft and Sons Co., Joseph
W. R. MacIntyre
Borden Co., The
William Callan
Brown Co.
Wentworth Brown
Buffalo Electro-Chemical Co., Inc.
Max E. Bretschger
Cabot Inc., Godfrey L.
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Carbide and Carbon Chemicals Corp.
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Catalytic Development Co.
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Celanese Corporation of America
George V. Schneider
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Champion Paper and Fibre Co.
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Ciba Pharmaceutical Products, Inc.
M. Donauer
Cities Service Oil Co.
J. C. Walker
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Commercial Solvents Corp.
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Consolidated Edison Co. of New York
Charles A. Lunn
Corn Products Refining Co.
W. B. Newkirk
Derby Co., The
Roland Derby
Devoe and Raynolds Co.
J. S. Long
Dewey and Almy Chemical Co.
C. H. Egan
Dorr Co., The
J. V. N. Dorr
Chester L. Knowles
Dow Chemical Co.
Mark E. Putnam
J. J. Grebe
Edgar C. Britton
DuPont de Nemours & Co., Inc., E. I.
Elmer K. Bolton
Ivan Gubelmann
John C. Woodhouse
John S. Beekley
E. R. Bridgwater
Walter E. Lawson
Durez Plastics and Chemicals, Inc.
A. F. Shepard
Eastman Kodak Co.
Emmett K. Carver
Geo. A. Richter
C. F. H. Allen
Ethyl Corp., The
George Calingaert
Foote Mineral Co.
Ernest G. Enck
Forest Products Laboratory
Carlile P. Winslow
Foster-Wheeler Corp., The
D. K. Dean
Freeport Sulphur Co.
Donald B. Mason
General Aniline and Film Corp.
E. C. Williams
Wm. F. Zimmerli
General Electric Co.
A. L. Marshall
General Motors Corp.
Harry C. Mougey
General Printing Ink Co.
William F. Talbot
General Refractories Co.
R. G. Abbey
Glidden Co., The
William N. Pritchard
Gulf Research and Development Co.
Eugene Ayres
Harshaw Chemical Co.
K. E. Long
Hercules Powder Co.
Emil Ott
J. L. Bennett
Heyden Chemical Corp.
Blythe M. Reynolds
Hooker Electrochemical Co.
R. L. Murray
Humble Oil and Refining Co.
H. D. Wilde, Jr.
Institute of Paper Chemistry
Harry F. Lewis
Interchemical Corp.
A. E. Gessler
International Minerals and Chemical Co.
Paul D. V. Manning
Kellogg Co., The M. W.
P. C. Keith
Howard Dimmig
Kimberley-Clark Corp.
John R. Fanselow
Koppers Co., The
B. J. C. van der Hoeven
Fred Denig
Lawrence Leather Co., A. C.
Kenneth E. Bell
Lever Brothers Co.
J. W. Bodman
Lummus Co., The
R. M. Torrey
Maas Chemical Co., A. R.
Fred C. Bowman
Marathon Paper Mills Co.
Allen Abrams
Carlyle Harmon
Mathieson Alkali Works, Inc.
Ralph E. Gage
Mead Corp.
John Traquair
Merck and Co., Inc.
Randolph T. Major
W. H. Engels
Monsanto Chemical Co.
Gaston DuBois
Francis J. Curtis
John J. Healy
Charles A. Thomas
Carroll A. Hochwalt
Lucas P. Kyrides
Thomas S. Carswell
National Aluminate Corp.
Paul G. Bird
National Carbon Co., Inc.
H. D. Batchelor
National Lead Co.
R. L. Hallet
National Oil Products Co.
Edwin A. Robinson
Naugatuck Chemical Division
Morris G. Shepard
Newport Industries, Inc.
Robert C. Palmer
Niacet Chemicals Corp.
C. J. Herrly
Niagara Alkali Co.
H. P. Wells
Norton Co., The
S. S. Kistler
Oldbury Electrochemical Co.
F. A. Lidbury
Orthmann Laboratories, Inc.
August C. Orthmann
Peoples Gas Light and Coke Co.
Robert B. Harper
Pfizer, Chas. and Co., Inc.
Richard Pasternack
Philadelphia Quartz Co.
Chester L. Baker
Pittsburgh Coke and Iron Co.
Wm. B. Brown
Pittsburgh Plate Glass Co.
F. W. Adams
Procter and Gamble Co.
H. S. Coith
F. W. Blair
Prophylactic Brush Co.
Gaetano F. D'Alelio
Quaker Oats Co.
F. M. Peters, Jr.
Reichhold Chemicals, Inc.
A. G. Hovey
Reilly Tar and Chemical Co.
Francis E. Cislak
Rohm & Haas Co., Inc.
Lloyd W. Covert
Charles S. Hollander
Rumford Chemical Works
Albert E. Marshall
Seagram, Jos. E. and Sons, Inc.
H. F. Willkie
Sharples Solvents Corp.
Jos. J. Schaefer
Shell Development Co.
Theodore W. Evans
Sherwin-Williams Co.
Robert F. Ruthruff
Spencer Kellogg and Sons, Inc.
A. Schwarcman
Standard Oil Co. of California
Ralph A. Halloran
Standard Oil Co. (Indiana)
J. K. Roberts
Standard Oil Co. of Ohio
Robert E. Burk
Standard Oil Development Co.
E. V. Murphree
Sun Oil Co.
J. Bennett Hill
Swift and Co.
Roy C. Newton
Tennessee Eastman Corp.
R. Leonard Hasche
Tennessee Valley Authority
Raymond L. Copson
Texas Co., The
L. C. Kemp, Jr.
Texas Gulf Sulphur Co.
W. W. Duecker
Union Oil Co.
Basil Hopper
United Gas Improvement Co.
N. K. Chaney
U. S. Industrial Chemicals, Inc.
Glenn Haskell
F. M. Hildebrandt
Universal Oil Products Co.
Gustav Egloff
Vanderbilt, Co., R. T.
Paul I. Murrill
Victor Chemical Works
Robert E. Zinn
Walker and Sons, Inc., Hiram
C. S. Boruff
West Virginia Pulp and Paper Co.
John W. Hassler
Westvaco Chlorine Products Co.
William T. Nichols
Weyerhaeuser Timber Co.
C. C. Heritage
Wyandotte Chemicals Corp.
H. F. Roderick

Rediscover the Rainbow

Dr. Willard H. Dow, president and general manager of the Dow Chemical Company, was awarded the 1943 Chandler Medal "for his dynamic and successful leadership in the American chemical industry . . . his accomplishment in expanding a chemical industry which depended upon Michigan salt brines, his daring enterprise in the direction of the extraction of bromine and of magnesium from sea water, the production of synthetic plastics and synthetic rubber . . ." Excerpts from his classic address of acceptance, presented at Columbia University in New York City, May 20, 1943, are included here.

THROUGH COUNTLESS centuries our forbears marvelled at the beauty and glory of the rainbow; the ancients often worshipped it as a manifest from Heaven. But the ancients, like so many in recent times, could not conceive of a Deity as other than a mere provider to man's material wants. They conjured up a pot of gold at the rainbow's end. In their simple and artless thinking they envisioned a real pot of real gold and thus a means to wealth and happiness. But the rainbow is not nature's way of pointing a shortcut to wealth. It is nature's way of indicating how we might better work for the wealth which nature has in store for us but will not give us merely for the asking. . . . I ask you to chase the rainbow with me, not so much for love of the chase but for the revelation of scientific percepts that will contribute to the betterment of all peoples.

We are in the midst of a holocaust of destruction in which apparently nothing is sacred or inviolate. The war, if it demonstrates anything, demonstrates that mankind as a whole is morally and politically unfit to apply the knowledge which science has placed at its command. Indeed, the thin veneer of civilization is easily rubbed off. Are we not today applying against mankind nearly all the forces and laws of nature which science has uncovered for the making of a better and happier living? Nowhere in nature do we find nature's laws operat-

ing for the exclusive benefit of a single group. The gifts of nature are available for each and all and when we attempt to limit their benefits or reverse their directions, we are recklessly opposing nature.

We know the applications of physics and chemistry follow natural laws, fundamentally so. On the other hand, it is a practical joke in industry to ask a highly trained, young, theoretical chemist to figure out the thermo-dynamics of some reaction. The answer usually comes back negative. However, the process is operating even if the theory does not fit. The point is that, generally speaking, the period of time for the particular reaction has not been taken into consideration—another natural law based upon a new variable often overlooked. A typical example of this is in the conversion of ethylene to butadiene. The skeptic might argue that these examples show the limitation of universal application of natural laws. Quite the reverse is the case. Man-made theories may encompass most of nature's laws but when they overlook any single factor they will invariably lead to false answers.

Nature's laws are immutable. We must learn and relearn that for every effect there is a cause. Does not everything have to work in order to reproduce its kind—with bacteria, insects, trees and humans, the same laws prevail. Always the results will be in proportion to the efforts put forth—an obvious natural law.

Is there a scientist who does not appreciate the concept of an omnipotent plan? Each synthesis, each reaction and all processing, the scientist watches with keen appreciation, hoping to discover some new phenomena. Our lives and all we direct are successful only in so far as we are able properly to interpret the magnificent plan.

The idea of one scientific development being a tool which helps in another development is clearly understood and appreciated by those with scientific experience and but slightly understood by others. . . . The extraction of bromine from ocean water was not a commercial economic process until comparatively a few years ago; and that was only because in earlier days we did not have the equipment with which to make possible the careful and exacting acidity control of the ocean water. For the first time in world experience we found how to handle enormous volumes of ocean water in continuous flow and at the same time control the acidity within narrow limits. That was the real key that opened commercially in 1934 the first lock of the vast resources of the ocean. Today thousands of tons of bromine are extracted annually from the ocean to the tremendous advantage of the Allies in aviation alone. What body politic a score of years ago could have directed or even wisely suggested the solution to such a problem? What "directive" could have substituted for unfettered imagination, the desire of the human being to show self-expression and to carry on against all kinds of obstacles?

MAGNESIUM'S STORY

Magnesium is an interesting story and perfectly simple. Perhaps that is the principal reason it is so difficult to understand. Magnesium is found in ample quantities in many localities, always in a combined state such as dolomite limestone or some other compound such as magnesium chloride, occurring in ocean water and native brines. In most localities where dolomite is found, fuel costs are fairly high or transportation charges constitute a large factor. The problem, therefore, quickly resolves itself into one of determining the relative cost of mining rock or pumping ocean water. We chose the ocean—deciding the volume was large enough to justify the investment. We made our decision and started plans within a few months, as the general method of isolating magnesium from brine had been in operation with us for 25 years.

When we first decided to extract bromine from the ocean, some of us were concerned about the possible contamination of organic matter and its effect on final recovery. This finally proved to be a will-o'-the-wisp, for the organic matter remained aloof. Thus our fears were dissipated.

On the other hand, many precautions were taken in the magnesium-from-sea-water extraction process. When the plant was finally started, we found it necessary to make some radical changes in order to prevent the concentration of borates from becoming too great in the electrolytic cells. Boron has the property in this electrolysis of being an active agent capable of reducing the yield of magnesium to practically nothing. Thus boron had to be controlled partly by elimination and partly by leaving the iron and manganese, naturally present, to control the boron. Here was an outstanding example of nature's elements in small quantities laying down a definite rule of operation; a control which none of us at that time thoroughly understood.

When one considers the chemical industry, its capacity is not measured in terms of machines, dies, jigs, etc. The chemical industry is measured in terms of physicists, chemists, chemical engineers, technicians and specialized equipment, including storage tanks, reaction vessels, fractionating columns and specialty items beyond number. The American public is apt to think of all production in mechanical terms, with little regard for the men who have made mechanical production possible. It is quite the old story, repeated again and again! In learning the meaning of natural laws and being guided by them we attain success, but the glamor of successful accomplishment is ofttimes confused by the milestones we pass on the way. There is probably no other industry in the country that touches as many phases of human endeavor as the chemical industry. Under all probability the chemists and physicists contribute basically more toward winning a war than any other group; they constitute the baker, the grocer and the candlestick maker all in one, in both war and peace-time. More than that, in these United States you cannot find a scientist, who is rightfully entitled to the name, who ever wanted war—he is too well aware of the consequences. Furthermore, true scientific progress can best be accomplished in peace-time.

WHAT OF THE FUTURE?

On the contrary, you will hear of war time developments and accomplishments which otherwise would have taken years to attain. What are we to believe? Shall we teach our children that it takes a war emergency to create real advance? Of course not! War emergency is one thing, peace is another. The two are not to be confused. There is no comparison. We also hear of highly placed men preaching that inventions should be curbed for the good of society. They are grotesquely misinformed. To invent is one of the freedoms of America. Every child has been taught to believe he may become an Edison of his day, and why not?

The ultimate changes in this world are infinite and, therefore, beyond human imagination. They are infinite because nature's laws are infinite. The bright spots of progress merely reflect the operation of natural laws. Every milestone of progress is but a period of more basic and clearer understanding, with the aid of the physical and chemical sciences, of the forces of nature and their laws. Finite milestones serve only to define nature. In no way does nature become less infinite. There are always greater possibilities and new horizons ahead of us. Nature attends. We must conform . . . Again, I ask you, consider the rainbow.

Training Women Operators for Chemical Industry

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Chem. & Met. INTERPRETATION

Manpower shortages in some of our important war industries are likely to become acute unless provisions are made to train women in even greater numbers than has hitherto been done. This is especially true of chemical industries, which have largely been operated by male employees. In this article, the author gives some good pointers on training programs by outlining the course given by the University of Pittsburgh to train women operators for the new butadiene-styrene plant of Koppers United Co. at Kobuta. *—Editors.*

The chemical engineering department of the University of Pittsburgh was recently called upon to train a large group of women operators for a new butadiene-styrene plant shortly to go into production in this area. Because of the specific nature of our assignment, some details of its execution will no doubt be of interest to those in other localities who might be faced with similar requests.

It is recognized and important to remember that a distinction must be made between chemical engineering education and that of training routine plant operators for a particular industry. The problem in the latter case can be stated in terms of limited vocational objectives. It is for this reason that a high degree of cooperation is necessary between the plant and the engineering school.

SELECTION OF TRAINEES

Inasmuch as the majority selected for training are to become operators of a particular plant, the company personnel division should be given the first opportunity to interview and select the candidates. Health examinations will eliminate the physically unfit. Intelligence testing has developed to the point where aptitudes can be evaluated and may, therefore, be used to good advantage. Statutory provision makes it necessary that all accepted candidates shall be high school graduates if the training course is under E.S.M.W.T. sponsorship. Mathematics, science, physics or chemistry are subjects which can be used, because of their discipline, in deciding between one high school graduate and another, especially in cases where the number wishing to take the course greatly exceeds the capacity for accommodation. The latter seems invariably to be the case. As in many E.S.M.W.T. courses, it is sometimes difficult to weed out those who feel entitled to attend merely for the educational value afforded. Interviewing of applicants by personnel officials will eliminate this group.

Because of competition between war plants for properly qualified or even potentially suitable workers, candidates accepted for the course may be immediately placed on the company payroll and paid at an hourly rate while attending school. This helps greatly not only in keeping enrollment high but in securing an economic advantage helpful to the educational process.

Recruitment of women for a training course must also be considered in relation to housing conditions in the immediate neighborhod of the plant they are to operate. As far as possible, the majority should be selected from the settled families in the vicinity of the plant.

These are but a few of the problems which must be worked out largely by the personnel officials in their selection of suitable student employees.

Here two women in training to become operators in a synthetic rubber plant are being shown how to read a mercury manometer

Courtesy Koppers United Co.

Before undertaking organization of the course, it is desirable to get a statement from the plant engineers as to the duties of the operators. Such a statement of broad objectives for a butadiene-styrene plant, suitably condensed, has proved helpful in organizing our program.

STATEMENT OF OBJECTIVES

Operations exclusive of maintenance and utilities may be divided into three steps:

(1) Distillation
  (a) Continuous
  (b) Batch
(2) Catalytic or converter operations
(3) Chemical treating or agitator operations

Continuous still operators will be required to check periodically the readings of instruments, such as flow meters on feed, reflux, bottoms and product lines, as well as gage pressures on column; temperatures on column, feed and reflux, etc. Recording, indicating, and control instruments will be placed on a panel board suitably located.

Operators must know how to adjust feed rate to prevent slowing down of operation at other steps in production. Periodic checking will be necessary during shift to ensure that pumps are operating properly, that vapors and liquids are not leaking through packing glands, etc., thus constituting a

fire hazard. Continuous still operators will be required to draw samples for analyses from the various streams and to keep records, during shift, of operating conditions. They will be required to report any defects noted in operating equipment.

The operator should be trained in the proper and safe operation of the unit and should be safety conscious. The safety of subordinates is a direct responsibility of the operator and applies in large measure to the safety of those working in the unit zone, servicing and maintenance crews.

Batch still operators will perform duties similar to those of the continuous still operators with the provision in this case that more complex mixtures will be separated. Stepwise cuts will be made on the batch under suitably controlled conditions as to boiling range, purity, etc. Special attention must also be paid to changing reflux conditions while distillation of the batch proceeds.

CONVERTER OPERATION

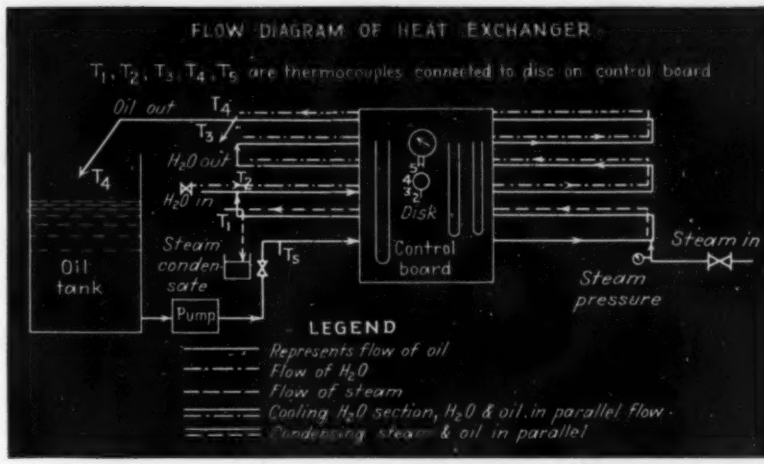
For butadiene-styrene plants using as primary raw materials ethanol and benzene, there are a number of catalytic converter operations. These reactions take place by passing the vapors over the catalyst at elevated temperatures. Many of the converters are large vessels containing tubes filled with catalyst. In certain cases, activity of the catalyst diminishes because of carbon deposit and the unit must be taken out of production pending reactivation of the catalyst with steam and air.

Specifically, the duties of a converter operator are governed directly by recording instrument readings. The operator must maintain a close control of the catalyst bed temperature by regulating the outside heating medium or heating appliances. Pressures and flow rate to the converter must also be regulated. Samples of the product are taken periodically on each shift to determine converter efficiency as an aid to the establishment of the operating temperatures.

Converters that can be reactivated in place require additional supervision and close control of temperature. Operators will be required to take gas samples and manipulate a gas analysis apparatus in order to adjust the degree of reactivation.

Where an outside heating medium is provided, simple adjustment of valves will serve to control temperature of catalyst bed. Converter operators must be on the alert at all times. They will be required to keep an accurate log of operations, adhere rigorously to temperature schedule, take samples during production for laboratory, make simple analyses during reactivation, operate controllers or regulating valves and be on the alert for fire or explosion hazards. Converter operators will be selected from those who show the highest ability during their training course.

Main agitator operations will be mainly concerned with the benzene refining unit. Two types of washings will be performed: washing an unpurified benzene with concentrated sulphuric acid, and washing purified benzene with a dilute oleum. The former removes unsaturated materials from the crude and the latter is effective in removing thiophene from the refined stock. The charge is treated stepwise with the acid, agitated, and then settled.



Simple diagrams such as this are used at the University of Pittsburgh to instruct prospective women operators in the fundamentals of heat exchangers

COURSE OUTLINE

It is obvious that any attempt to duplicate the layout of a butadiene-styrene plant in a chemical engineering laboratory would not only be costly in time and money but also of doubtful value. On the other hand, a sufficient number of regular laboratory units must be available if the course is to be worthwhile. These units are already available in most chemical engineering departments and have been built or purchased over a period of years. Institutions wishing to undertake similar courses but who lack the necessary items of equipment would be well advised not to entertain the idea. It is our opinion that lectures on the chemistry of butadiene-styrene production, however well organized and illustrated, will in no way be a substitute for the lack of engineering equipment. Because of the objectives already stated, the academic approach is without much value.

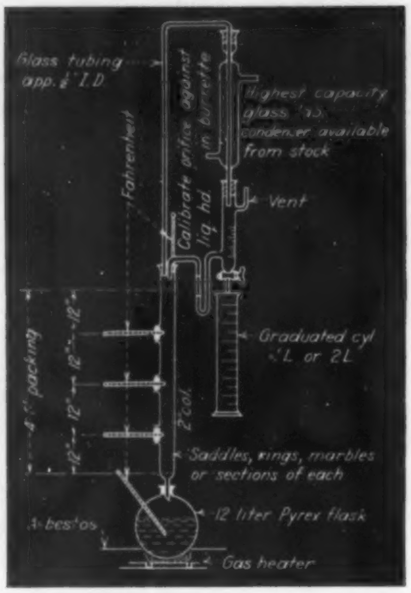
Consider a typical group of women students, medium age 24, age limits 18 to 40, who come in for training. They are from widely different occupational levels—housewives, secretaries, stenographers, saleswomen, school teachers, beauty parlor operators, and factory assistants—eager to serve in the war of production. Our laboratory facilities permit the accommodation of 60 in a group of day students working 32.5 hr. per week, and a group of 60 at night working 9 hr. per week, each for a total of 227½ hr.

Students are divided first into groups of 12 per instructor, and then subdivided according to the work being done. During the first two weeks of the day program the elements of operation are considered. These comprise weighing, measurement of volume, pressure, flow of fluids, temperature, machine shop, and others.

In the weighing group, a woman will handle materials and items of plant interest from a gram to one-half ton. She will also recognize the difference between copper, brass, cast iron and steel valves and fittings. Her log sheet will require measurement of items being weighed so that they may be classified in terms of nominal sizes. No formal lecture is given on the theory of errors; the instructor has merely to await the inevitable discussion as to who is right.

In volume work, a number of commercial containers have been assembled which range from glass cylinders to 55-gal. drums. Linear measurements are taken on tanks in the laboratory and calculations made to determine the weight and volume of solutions and pure liquids.

Pressure measuring devices such as draft gages, Bourdon gages and manometers are studied in carefully constructed set-ups. Principles of operation and calibration in the case of



Principles of distillation are easily demonstrated to prospective women chemical operators by such set-ups as shown in this drawing

Bourdon gages by dead weight testing are fully explained by actual handling. Students are then required to inspect regular units of equipment and to identify the placement of pressure indicating devices.

The section on temperature is required to study thermometers, thermocouples, recorders and indicating controlling pyrometers. They will be concerned with the placement of thermocouples in flues, columns, vapor and liquid lines.

Elements of flow as measured by orifices, rotameters, wet and dry meters and other instruments provide a well coordinated activity.

MACHINE SHOP GROUPS

Machine shop groups may be assigned to a variety of occupations such as cutting and threading pipe, sorting and classifying fittings, assisting in installation of pieces of equipment, pumps, valves, tees, etc., checking valves for tightness or handing out stock as needed. A log sheet is required of each student mechanic group so that time on the job is duly accounted for. The laboratory mechanic is largely responsible for seeing that tools are handled properly. The instructor usually devotes his time to explaining the different types of valves, fittings, tools, machines in the shop, and also lays out the repair job.

At the end of the second week each group has completed the first set of assignments. Because of differences in ability to perform computations, a continuous session is held during the first week to assist the weaker members of the group. In this type of work where time is an important factor, the instructions for each assignment should be clearly stated. The purpose of the course will be defeated if the entire mimeographed set of instructions is handed out at the first meeting. This is especially true of the first two critical weeks when discouragement may seriously jeopardize enrollment. By having mimeographed items for each assignment, clearly stated and as brief as possible, this feeling will be offset.

The third week may be split up to meet different needs: the slower ones can catch up on items missed; the smarter ones can get the control unit organized to test the material to be used in regular production units.

PILOT PLANT STUDIES

At the beginning of the fourth week, work is started on the pilot plant equipment in the chemical engineering laboratory. The present items in use at this laboratory include:

(a) **Distillation unit: eight foot packed column (6 in. diameter), with feed and reflux pumps, rotameters, thermocouples and sample taps, atmospheric pressure operation, system isopropanol-water. Controls on continuous operation on feed, product and bottoms by gravity measurements.**

(b) **Converter, unit, electrically heated and controlled: reaction, dehydration of hexanol, catalyst alumina. Percentage conversion to hexene for given rate of throughput at fixed temperatures between 650-850 deg. F. determined by batch distillation of small samples.**

(c) **Hydrogenation of co-dimer is also studied under similar conditions.**

(d) **Heat exchanger operation: commercial size unit using 5 lb. steam for heating straw oil, provided with orifice meters, thermocouples, and centrifugal pump. Control of conditions to produce specified temperature. Cooling of batch by circulating oil countercurrent to water. Heat balance on unit.**

(e) **Cabinet drier: humidity and temperature controlled 6 trays. Records kept of temperature, air velocity over trays, humidity and weight of material on each tray during run. The switch from automatic instrumentation to manual control is readily demonstrated by this unit.**

(f) **Absorption unit: operation of countercurrent air and water sprays in glass-packed column. Demonstration and correction of flooding conditions by each operator when called upon by instructor.**

(g) **Evaporator units: long tube atmospheric type, basket type, vacuum operated.**

The above units are laid out on a production basis and not as is usual in the chemical engineering course to demonstrate principles. There should be enough activity to keep a simple type of control lab operating and a sufficient amount of reconstruction going on to keep a repair crew busy. Operators report directly to a squad leader who is responsible for the smooth running of the unit. It is not difficult to pick out those who can take their share of responsibility, and information of this sort is valuable to the plant engineers and company officials. Emergencies also arise where quick thinking is needed and the remedial measures adopted can be used to pick out the valuable operators.

LENGTH OF COURSE

Any discussion on the most desirable length of a training program is highly controversial. If, however, the objectives are clearly stated and the duties of the operators to be trained properly defined, the problem is greatly simplified. Local conditions must be studied. If the plant is built and ready to operate, the university should discharge its responsibility as quickly as possible and provide the operators needed. Draft boards in the past have granted six months deferment to men of military age in chemical plants to allow for training substitutes for their replacement. This is a generous allowance in many cases and there is no assurance that it will be continued. In the Pittsburgh district, representatives of the W.M.C. have warned employers that they face the loss of draftable men on short notice, regardless of their occupational status.

Company needs will, therefore, be the main determining factor in controlling the length of the training program. In these days, time is precious; and if, by eliminating all that will not be used, we can train women to replace men in the chemical industries, a distinct service will be rendered to the war program.

The university or engineering school can render a distinct service in this field because of experience and facilities. The program, however, should be initiated by the particular plant or industry rather than by the school itself. Exact needs are largely known accurately by the plant engineers who are, therefore, in a position to specify and initiate the training program. This type of training in no way resembles the regular chemical engineering course. It is a separate and distinct enterprise calling for different treatment and having objectives not at all related to our normal peacetime activity.

Industrial Hygiene Problems in the Synthetic Rubber Industry

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Chem. & Met. INTERPRETATION

New processes and raw materials, we well as inexperienced personnel, always tend to emphasize hazardous situations, and the greatest enemy of industrial health, as well as industrial safety, is ignorance. This statement might well apply to our synthetic rubber industry now being created, our newest and soon to be one of our largest process industries. The highlights of hazardous operations in the manufacture of various synthetic rubbers are given in this article, intended especially for supervisory and operating chemical engineers working or planning to work in the industry.—*Editors.*

NEOPRENE manufacture has been thoroughly worked out in this country and there has been more experience with it than with most rubber substitutes. The chief hazardous materials in the synthesis are acetylene, vinyl acetylene, and chloroprene.

Acetylene may be classified with the asphyxiant gases. In fairly high concentrations it has a depressant effect on the circulation and respiration and is somewhat narcotic. In the few recorded cases of industrial poisoning there is question as to whether the harm was done by the acetylene itself or by hydrogen sulphide or phosphine which it commonly contains as impurities. Vinyl acetylene is probably somewhat more toxic than acetylene, but still would be an asphyxiant.

Like many other chlorinated compounds, chloroprene (a liquid boiling at 138 deg F.) is considerably more toxic than its parent hydrocarbon. When inhaled in comparatively low concentrations it causes irritation of the respiratory tract. Continued exposure may produce a fall in blood pressure, reduction in the respiratory rate and cyanosis. The most serious effects are damage to the liver, kidneys, and testicles, and internal hemorrhage due to the hemolytic action. Von Oettingen suggests that concentrations of 0.3 milligrams per liter, corresponding to about 100 p.p.m., may cause toxic effects on long exposure. The maximum safe concentration will, consequently, be something below this value. Chloroprene may be absorbed directly through the intact skin and produce about the same effects as it does by inhalation.

Processes involved in these syntheses will be carried on in closed systems and the materials handled through pumps and piping. The dangers to be considered, therefore, are due to leaks in the systems and to acute exposures from cleaning tanks and piping. One of the larger rubber companies suggests the following precautions in handling processes of this sort where toxic and highly explosive liquids and gases are used:

(1) Escaping vapors must be removed at their source by exhaust ventilation. Coupled with this they recommend general ventilation at the rate of 20 air changes per hour.

(2) Exhaust ducts should be located at points where vapors are likely to be released, such as valves, gauge glasses and similar locations and also in pits and other dead air spaces where vapors might collect.

(3) Skin contact with the liquid should be prevented by proper protective clothing.

Safety rules for cleaning out pressure vessels cannot be too strict; the following precautions must be taken:

(1) All valves should be closed and sealed unless a safety man is stationed at such points to prevent their being opened.

(2) Any agitators or other moving equipment must be locked out.

(3) Before entering any such vessel it must be thoroughly purged. This can be done by filling the vessel with water, steaming, applying vacuum, and exhausting. Before opening, evacuate to as much vacuum as possible, bring to zero gauge pressure with nitrogen, and repeat this process a second time.

(4) Workman entering such a vessel must be provided with suitable safety equipment such as goggles, rubber gloves, and forced air masks.

(5) Any extension light used must be of the approved vapor-proof type.

(6) The workman must wear a manhole harness with a strong lanyard attached, and another workman must remain on the outside and retain hold of the lanyard. In some cases where the manhole is near the bottom of the tank it may be practical to omit the manhole harness but there still must be another workman detailed to the specific duty of observing the workman who is inside.

(7) The workman in the vessel must be instructed to come out at the first indication of dizziness or illness and removed to clean air.

(8) It must be borne in mind that the vapors of many of the materials used in these processes when mixed with air are highly explosive.

Except for the production of chloroprene vapors, no further hazards should be experienced in the polymerization of chloroprene. The phenyl beta naphthylamine added to the polymer to retard aging or further polymerization, is not generally considered to be very toxic. We feel, however, that exposure to it should be avoided because of the possible long-range effects. Beta naphthylamine has been cited as a cause of bladder tumors in dye workers, and the addition of the phenyl group would probably not decrease its carcinogenic activity.

BUTADIENE AND STYRENE

What directly concerns the manufacturer of rubber substitutes is the materials he receives to polymerize. The material handled in greatest volume will be butadiene. This is a liquid at 26.6 deg. F. It may produce irritation of the eyes, nose and throat, but apparently has no cumulative effect. Below the lower explosive limit of two percent it is mildly narcotic and strongly so in higher concentrations. There is very little information in the literature on the physiological effects of butadiene. The recorded observations, mainly concerned with the

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This article is a condensation by the editors of a paper delivered by the authors before the Rubber Section of the Thirty-First National Safety Congress, Chicago, Ill., Oct. 27-29, 1942.

Courtesy U. S. Rubber Co.

Buna S latex is bulked and blended in these huge wooden tanks

effects of repeated heavy exposures, may have to be modified when there has been a more complete study of the effects of continued exposure to low concentrations. It should be obvious that skin contact with the liquid is dangerous, due to its low boiling point.

Styrene is a liquid boiling at 293 deg. F. It has a powerful odor which will prevent prolonged contact with large concentrations if the man involved is a free agent. This cannot be relied on as a control measure, however, as the senses are usually dulled when the sense of smell is offended for a long period. Exposure to the vapors may cause skin irritation and conjunctivitis. The vapor is also narcotic in comparatively small concentrations. Irritation of the lungs and liver and kidney damage will follow heavy exposures. Concentrations of 200 p.p.m. are said to be about the safe maximum.

ACRYLONITRILE

Acrylonitrile is a liquid boiling at 172-174 deg. F. The toxic effects are apparently due to formation of hydrogen cyanide in the body after absorption. According to the U. S. Public Health Service, a typical cyanide reaction follows absorption. The safe limit should be 20 p.p.m. or less. This is by far the most dangerous substance so far discussed and should be handled only with the most extreme precautions. The effects are apt to be acute and anyone who shows the slightest symptoms should receive immediate medical attention. Cyanides are easily absorbed through the skin and it would be well to consider the same occurs with this compound, at least until there is evidence to the contrary.

Polymerization is usually carried out in a water emulsion, with the addition of soaps as emulsifying agents, catalysts (such as peroxides, persulphates or peracids), and modifying agents which may be halogenated hydrocarbons, nitriles or sulphur compounds. These modifying agents are generally materials of known high toxicity and should be handled with care. The point of maximum hazard would probably be the removal of modifying agents from the latex resulting from polymerization.

The member of this group which will be commercially important is the copolymer of butadiene with isobutylene. This introduces the new hazard of butenes, which are probably below butadiene in toxicity. Butenes are colorless gases with boiling points between 21-36 deg. F. There is no reason to believe that control measures should be other than those recommended for butadiene. In polymerizing butene with butadiene to form butyl rubber, two highly volatile and flammable gases are being handled at the same time, which would make fire and explosion hazards greater than with other copolymers thus far discussed.

THIOKOLS AND VINYL POLYMERS

Thiokols are made by condensing sodium polysulphide with chlorinated hydrocarbons. Depending upon which chlorinated derivative is chosen, a variety of rubbery materials can be obtained. The two chlorinated derivatives most frequently used are ethylene dichloride and dichlorethyl ether, both highly toxic.

Etheylene dichloride is a liquid boiling at 183 deg. F. with vapors of the same degree of toxicity as those of carbon tetrachloride. The suggested maximum permissible concentration is 100 p.p.m. Irritation of the throat, coughing and vomiting have been reported as initial symptoms. The possibility of liver damage and other effects of prolonged exposure to moderate concentration indicates the need for keeping the vapors out of the breathing zone of workers. Dichlorethyl ether is a liquid boiling at 352 deg. F. Its close relation to the war gas, dichlorethyl ether, suggests that it too may cause irritation to the eyes and lungs. One state has set a maximum permissible concentration for the vapors at 15 p.p.m.

Because the reaction takes place in aqueous medium and the product is coagulated with acid, the hazard of hydrogen sulphide must be considered in both parts of the process. Past experience has shown that hydrogen sulphide may cause nausea, headache, and irritation of the eyes, as well as loss of appetite and loss of weight when workers are exposed even to moderate amounts day after day. Therefore, hydrogen sulphide should be removed at the source of generation so that the concentration in the workroom air does not exceed 20 p.p.m. At least one article has appeared in which the source of Thiokol odors has been discussed. It is believed that ethylene mercaptan and other sulphide-containing compounds are formed. These may be highly toxic as well as disagreeable. Efforts to keep the hydrogen sulphide out of the workroom air should be just as effective with these other compounds.

Two of the most important members of the vinyls are polyvinyl butyral and polyvinylidene chloride (Saran). Common to all of these compounds is the hazard of acetylene, the basis for synthesis of the monomers. The monomer for polyvinylidene chloride is made by treating dichlorethane with alkali.

Among harmful materials involved in making other monomers and in polymerization may be mentioned hydrogen chloride, butyraldehyde, and several catalysts such as mercuric sulphate, benzoyl chloride and uranyl acetate in methanol. The various processes are carried on in a closed system. Therefore, the precautions given previously for such handling, proper ventilation and avoidance of skin contact, should be observed.

MIXING AND VULCANIZING

Synthetic rubbers which will be most important commercially will be compounded and handled in much the same manner as natural rubber. This is more than a coincidence, for otherwise the rubber fabrication machinery now available would be useless.

Most of us are familiar with the early history of the rubber industry with regard to hazards from accelerators and antioxidants. Aniline and some of its derivatives, "hexa" (hexamethylenetetramine), the toluidines and paraphenylenediamine caused so many cases of poisoning and dermatitis that there was a rush to develop harmless or less harmful substitutes. With some of the nowcomers there have been no reports of harmful effects, but much of this information has come from direct questioning of manufacturers rather than from toxicological experiments.

Agents most frequently mentioned in the fabrication of synthetic rubber are diphenylguanidine (D.P.G.),

phenyl betanaphthylamine (Agerite powder), phenyl alphanaphthylamine (Neozone), mercaptobenzothiazole (Captax), tetramethylthiuramdisulphide (Tuads), the dihydroquinoline derivatives (Flectols, Agerite syrup), hexamethyleneammonium dithiocarbamate (Latec), dinitrophenyldimethyldithiocarbamate (Safex). Because some of these materials may contain known toxic substances as impurities (Neozone D contains free aniline) and because of the possibility of harmful effects after long exposure, direct contact with these materials by inhalation or skin contact should be avoided.

Among the plasticizers commonly used with synthetic rubbers, dibenzyl ether and tributyl phosphate have caused irritation to the respiratory tract, even nose bleeds. The chlorinated naphthalenes have a long history of serious dermatitis and of poisonings which may be fatal. They have been recommended as plasticizers, especially for the extrusion of neoprene, but should be used very cautiously. This means avoiding contact either by skin or by inhalation of condensed vapors. One of the more obvious means of preventing harm from these materials, which are poisonous by skin contact, is personal cleanliness.

Although no dust should be promiscuously disseminated into the atmosphere, toxic dusts should be especially avoided. The inorganic accelerators most frequently recommended are the oxides of zinc and magnesium; these may create a nuisance but have not been shown to have any definite harmful effects. However, lead and mercuric oxides have been recommended and used for special properties. These should be most carefully controlled both in weighing out and incorporating on the mill. Lead has also found use in the form of a soap during polymerization by emulsification. Of course, such use also calls for extreme caution in handling.

SOLVENTS

A variety of solvents are used for preparation of cements and extrusion mixtures, coating fabrics and other materials, and forming seams in some of these coated materials. The synthetic rubbers have the outstanding property of resistance to many solvents which cause swelling and disintegration in natural rubber. Therefore, we must use special solvents when cements and other soft products are made. Coal-tar solvents are especially popular. Some have recommended coal-tar naphtha (solvent naphtha), a mixture of benzol, toluol and xylol, having definite toxic properties.

Benzol itself is being used to a great extent, especially since the so-called safe substitute, toluol, has been restricted by other war needs. The controversy about toluol as a safe solvent seems to be unending. We do not feel that it has been conducted from an unbiased or scientific viewpoint. Our opinion is that boiling point alone does not determine relative toxicity; one must know the actual concentration of vapor in the air. We do know that toluol has an appreciable vapor pressure at room temperature and that severe poisoning and at least one death have resulted from its promiscuous use.

Nothing will be gained by seeing how much the worker can absorb before blood changes are observed. The fact that there have been cases of chronic poisoning from exposure to relatively low concentrations of toluol would indicate that safe practice requires keeping the concentration as far below the suggested safe limits of 100—200 p.p.m. as is practicable. Several years ago a limit of 75 p.p.m. was suggested for benzol. The A.S.A. has raised this to 100 p.p.m.; why we do not know.

Ethylene dichloride and monochlorbenzene are the most common of the chlorinated solvents. Both are highly toxic, suggested limits being 100 p.p.m. for ethylene dichloride and 75 p.p.m. for the monochlorbenzene compound.

Other solvents frequently used, especially for vinyl polymers, are methyl ethyl ketone and butanol. Methyl ethyl ketone is considered probably more toxic than acetone; therefore the safe limit would appear to be somewhere below 200 p.p.m. The suggested safe limit for butanol has been set at 100 p.p.m.

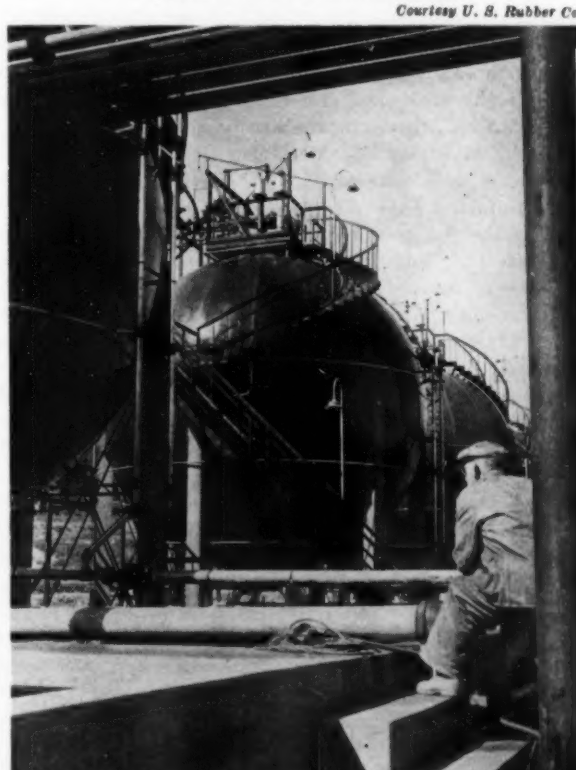
Buna S and the butyl rubbers appear to be the only common synthetic rubbers which are appreciably soluble in aliphatic hydrocarbons. If the petroleum naphthas used for dissolving these contain aromatics, as many have been found to do, the suggested safe limit of 1000 p.p.m. must be scaled downward. Before using solvents, or for that matter accelerators or anti-oxidants which are identified only by trade name, it is wise to learn what they really contain.

Because so many instances have been observed in industry where a window exhaust fan or wall fan is considered proper ventilation, we mention here that we do not generally approve such installations. Positive control of solvent vapors calls for removal of vapors as close to the point of generation as possible, and in such a way as to carry the exhausted air away from the worker. Nor is the current rage for down-draft exhaust entirely justified. The vapors of most of these solvents are heavier than air and should fall, but it should be obvious that a down-draft exhaust beneath a table cannot possibly remove solvent vapor from the top without the workers along the edge of the table getting it first. This does not mean that ventilation near the floor should not be used to reduce fire hazard, but it does mean that it is not necessarily effective in protecting workmen from inhalation of vapors.

Vulcanization processes can give rise to a number of toxic gases, such as hydrogen sulphide, carbon disulphide and mercaptans. When neoprene was introduced into fabrication processes there were frequent complaints of a "tear gas" generated during vulcanization. Most processors claim that recent grades give no obnoxious gases.

Butadiene gas, which may produce eye and nasal irritation, is stored in liquid form under pressure in giant spherical tanks such as these

Courtesy U. S. Rubber Co.



Specific Heats of Mixed Acids at Higher Temperatures

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Chem. & Met. INTERPRETATION

War uses of mixed acids in explosives manufacture have greatly stimulated the need for more basic data on thermal properties, particularly specific heats of nitric and sulphuric acids in various strengths and mixtures and at other than room temperatures. The authors here describe work at temperatures in the range of 104 to 212 deg. F. and show that change in specific heat of mixed nitration acids with temperature is small. —*Editors.*

Basic data for calculations of the heat involved in the preparation and use of mixed acids for nitration processes include the measurement of heats of dilution by Rhodes and Nelson (6),[3] and the determination of specific heats of nitric and sulphuric acids in various strengths and mixtures by Biron (1) and Pascal and Garner (5). The specific heats have been correlated and made more available to American readers by Zeisberg (10) and Craig and Vinal (2). More recently these data have been presented in an enthalpy and specific heat plot by McKinley and Brown (4) and in an enthalpy-temperature nomograph by McCurdy and McKinley (3).

Specific heat determinations previously reported have all been made at or near the temperature of 68 deg. F. (20 deg. C.), and the enthalpy plots have been based on the assumption that the change in specific heat with temperature was negligible. The work reported here was well under way before the enthalpy plot of McKinley and Brown appeared. On account of the difficulties in the calibration of the apparatus and in the determinations of heat capacities at higher temperatures the results may not represent the same degree of accuracy as some of those given for 20 deg. C. (1), (5), (7). However, they do represent data obtained with fair accuracy at four temperatures in the range from 40 deg. C. to 100 deg. C. (104 deg. F. to 212 deg. F.), and they do show that within this range the change in specific heat of mixed nitration acids with temperature is small.

The authors made use of a calorimeter in which the sample of mixed acid was placed in a glass jar through the cover of which a heating element, stirrer and thermometer were introduced. The heating element consisted of a nichrome coil inserted into a glass tube which was then bent to an appropriate shape. The calorimeter jar was well insulated from a jacket which was heated by another coil and kept at a temperature somewhat above but close enough to the temperature in the calorimeter jar so that the heat leakage through the insulation was negligible. The calorimeter heater was designed so that when operated continuously it caused a temperature rise of 0.5 to 1.0 deg. C. per min. in the weight of sample (255 cc.) used.

In starting a determination the jacket temperature was adjusted and the stirrers allowed to run at least ten minutes to get constant conditions before the initial temperature reading was taken and the calorimeter heater turned on. Thereafter readings of the calorimeter temperature to 0.01 deg. C., and of the heater current to 0.05 v. and 0.0025 amp. were taken at regular intervals until the temperature rose to 100 deg. C. The rise in temperature (ΔT) for a 5.00 minute interval was then plotted against the calorimeter temperature. From the average curve for this plot ΔT for the standard time interval was read for each desired temperature.

In the calculation of results the following modification of the ideal calorimeter equation (8) was used:

$$C_p = \frac{KAVt}{W\Delta T}.$$

In this equation, C_p is heat capacity in calories per gram; K, calorimeter constant including the conversion factor 0.239 calories per joule; ΔT, rise in temperature for time t; V, average voltage; A, average current in amperes; and t, time in seconds.

K in this equation is constant only at a given temperature and in the determination of its value it was found that the viscosity of the standard liquid influences the value found for K. Wilson and McCabe (9) have likewise reported that water gave results 3 to 4 percent higher than caustic soda solutions in the calibration of a bomb. In the present work water and glycerine were also tried, but ethylene glycol was chosen for the determination of the values for K, because it has a low vapor pressure at the desired temperatures and its viscosity approaches that of the acids studied.

The method used in systematically exploring the mixtures of acids may be explained by use of Fig. 1, a triangular diagram for the composition of mixtures of three components. The line B represents the composition of mixtures in all proportions of 91.9 percent sulphuric acid and 68.5 percent nitric acid. Determination of the heat capacities of these acids and a number of the mixtures of the two in varying proportions give data which were plotted for each desired temperature as shown in Fig. 2. From the average curve of the plot in Fig. 2 there could be read for different mixtures the heat capacities in calories per gm. per deg. C., or specific heat at this temperature. This gave data as shown in the accompanying table.

(*Please turn to page* 124)

Specific Heats at 80 deg. C. of Mixtures along Line *B* of Fig. 1

Composition, Percent					
91.9% H_2SO_4	68.5% HNO_3	H_2SO_4	HNO_3	H_2O	Specific Heat
0.0	100.0	0.0	68.5	31.5	0.57
9.0	91.0	8.3	63.0	28.7	0.55
32.0	68.0	29.4	46.6	24.0	0.50
60.0	40.0	55.1	27.4	17.5	0.45
88.0	12.0	80.9	8.2	10.9	0.40
100.0	0.0	91.9	0.0	8.1	0.38

[1] Present address: E. I. duPont De Nemours & Co., Wilmington, Del.

[2] Present address: Floridin Company, Warren, Pa.

[3] Refer to bibliography at end of article.

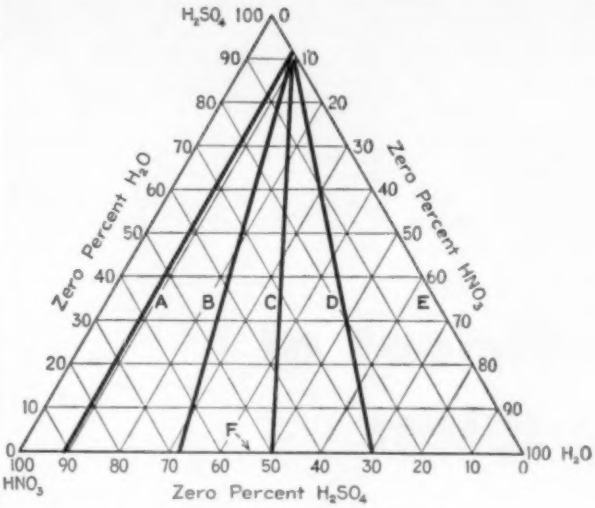

FIG. 1 — Typical Compositions for 3-component Mixtures

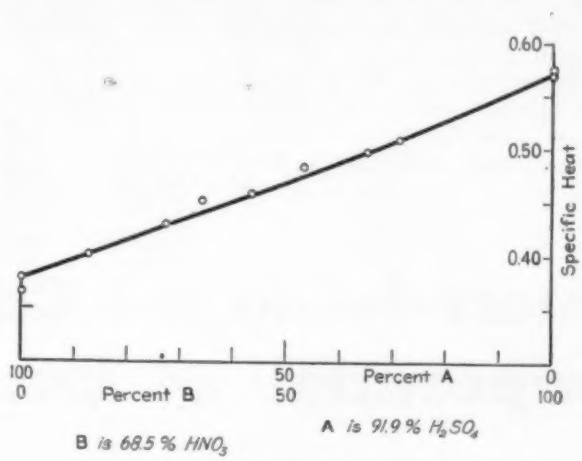

FIG. 2 — Specific Heats of Mixtures Along Line B of Fig. 1, 80° C.

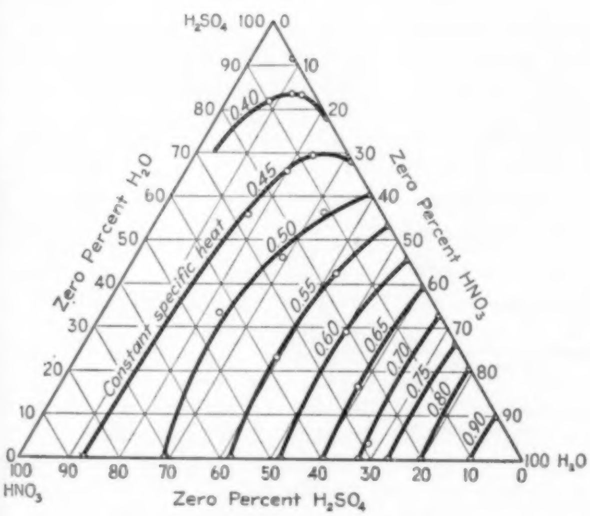

FIG. 3 — Specific Heats at 40° C.

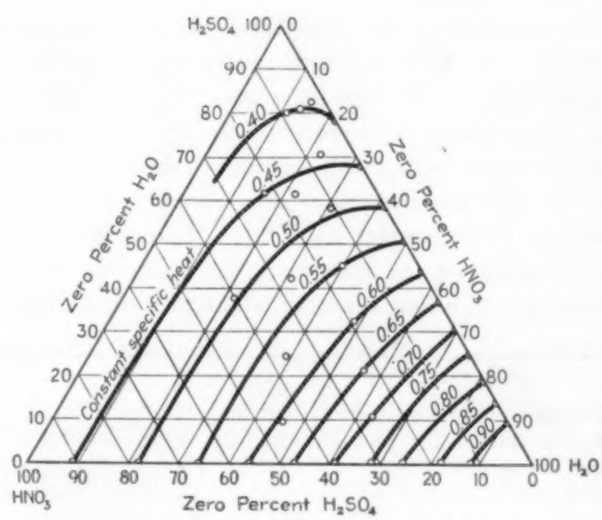

FIG. 4 — Specific Heats at 60° C.

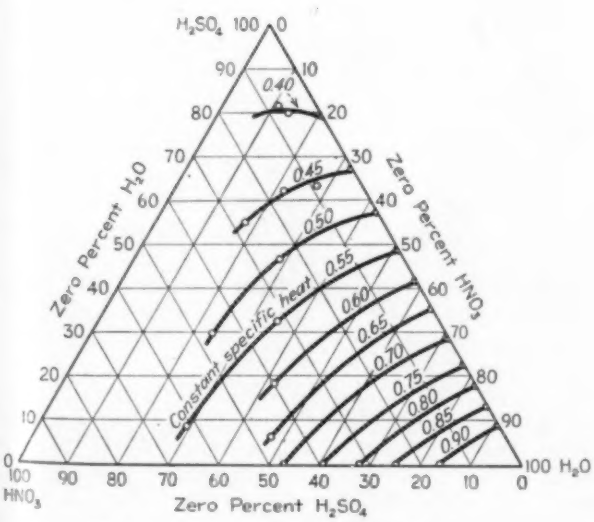

FIG. 5 — Specific Heats at 80° C.

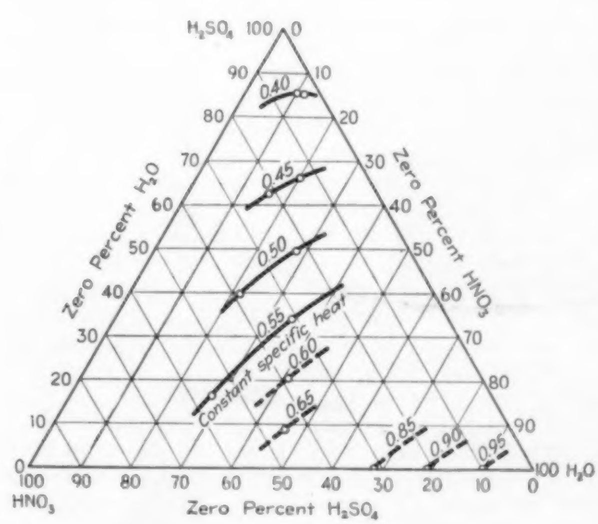

FIG. 6 — Specific Heats at 100° C.

By a repetition of this process, data were obtained for specific heats at 40, 60, 80, and 100 deg. C. for mixtures of acids with the compositions fixed by the different lines shown in Fig. 1. These data are summarized in the curves of equal specific heats on the triangular composition charts of Figs. 3, 4, 5 and 6, from which the specific heats of most mixtures of sulphuric acid, nitric acid and water from 104 to 212 deg. F. may be estimated.

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Determining the Coefficient of Evaporation of Humidifiers

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Chem. & Met. INTERPRETATION

Before discussing the coefficient of evaporation of humidification apparatus, the author clears up the often puzzling matter of the distinction between the wet-bulb and the adiabatic saturation temperatures encountered in psychrometry. He then defines the coefficient of evaporation in both exact and approximate forms, and shows how it and the exit absolute humidity can be determined for humidifiers when the heat transfer coefficient is known. Conversely, he shows how to calculate the heat transfer coefficient for the case of a coke-packed tower, when the coefficient of evaporation is known.—*Editors.*

Before discussing the coefficient of evaporation, the temperature of adiabatic saturation must be correctly defined and its relation to the wet-bulb temperature made clear, since the validity of the method of determination given hereafter rests upon this relation, while the accuracy of determination is dependent upon the exactitude of the adiabatic saturation curves.

The equation defining the temperature of adiabatic saturation t_s of an unsaturated mixture of any carrier gas and any vapor at temperature t and absolute vapor content w is:

$$\overset{(A)}{Ct} + \overset{(B)}{L'w} + \overset{(C)}{c_{pv}(t-t')w} = \overset{(D)}{Ct_s} + \overset{(E)}{L_s w_s} \qquad (1)$$

where term (A) is the sensible heat in the carrier gas; term (B) is the latent heat in the vapor; term (C) is the sensible heat in the vapor (superheat); term (D) is the sensible heat in the carrier at saturation; and term (E) is the latent heat in the vapor at saturation. The lefthand side of the equation, terms $(A) + (B) + (C)$, represent the total heat in the unsaturated mixture; while the terms on the righthand side, terms $(D) + (E)$, represent the total heat in the saturated mixture. In this relation of Equation (1), L' and L_s are the latent heats of vaporization of the vapor at the dewpoint and at saturation, respectively, in B.t.u. per pound of carrier gas, t' is the dewpoint temperature of the unsaturated mixture, w_s is the absolute vapor content at saturation in pounds per pound of carrier gas, and C and c_{pv} are respectively the specific heats at constant pressure of the carrier and the vapor in B.t.u. per lb. It will be noted that the vapor present in the unsaturated mixture was vaporized at the dewpoint.

If the above relation is plotted on the psychrometric chart for different values of t_s (see Fig. 1), the result is a family of curves called adiabatic saturation lines, which are the locuses of all unsaturated conditions having the same adiabatic temperature. The curvatures of these lines, which are concave upward, increase with the corresponding value of t_s.

Rearranging Equation (1), after adding the quantity $L_s w$ to both sides, gives the equivalent equation of the adiabatic saturation lines:

$$C(t - t_s) + c_{pv}(t - t')w + (L' - L_s)w = L_s(w_s - w) \qquad (2)$$

Under this form, it will be seen that the heat required to vaporize the added vapor (righthand term) is supplied by: (*a*) the decrease in sensible heat of the carrier (first term on left), (*b*) the disappearance of the superheat in the original vapor (second term on the left), and (*c*) the disappearance of the extra latent heat in the original vapor due to the change in dewpoint. The added vapor is vaporized at temperature t_s and since the expressions of total heat in Equation (1) do not include the heat in the liquid, any makeup water must be supplied at this temperature.

Equation (1), or more simply the adiabatic curves which express it, will permit the determination of the absolute vapor content of an unsaturated mixture for a given value of its temperature if t_s is known. The dry-bulb temperature t can readily be determined by means of an ordinary thermometer. Is it then possible to measure t_s by any simple method?

Let us place in a current of unsaturated carrier gas various evaporation surfaces differing both in shape and size (Fig. 2). The carrier gas picks up vapor as it contacts the wetted surface, despite the fact that no outside heat will be supplied for vaporization except by radiation from the surroundings. Furthermore, if the velocity of flow is sufficient, radiation effects will be negligible and the experiments can be considered adiabatic. The thermometers in each case will give the temperature of the liquid being vaporized. Runs are made not only with different surfaces but also with different velocities and different unsaturated mixture conditions. In all cases an equilibrium will be reached

when the temperature of the liquid stabilizes at a definite value t_w called the wet-bulb temperature.

WET-BULB TEMPERATURE

These experiments show that in the particular case of air-water vapor mixtures, for given unsaturated conditions, t_w remains the same whatever the velocity or size and shape of the surface. For all practical purposes it is equal to the temperature of adiabatic saturation t_s. However, these experiments also show that this fortunate fact is not general and does not apply to all carrier-vapor mixtures. In the particular case of air-water vapor mixtures, the temperature of adiabatic saturation and therefore the absolute humidity can be determined by the wet-bulb method, but this is not true of all carrier-vapor mixtures.

From the fact that the wet-bulb temperature is independent of velocity and evaporation surface results the fact that the coefficient of heat transfer in this process and the coefficient of evaporation are bound by a constant ratio dependent solely on the unsaturated mixture conditions. Effectively, the condition for adiabatic vaporization can be written:

$$h\,(t - t_s) = L_w K (w_s - w)$$

or

$$\frac{\omega_s - \omega}{t - t_w}$$

$$\frac{h}{K} = L_w \frac{w_w - w}{t - t_w} \qquad (3)$$

in which K is the coefficient of evaporation in pounds per sq.ft. per hr. per pound difference in absolute vapor content and h is the coefficient of heat transfer in the process in B.t.u. per sq.ft., hr. and deg. F. It is important to note that the latter is not simply a coefficient of convection since it includes, along with the heat transfer from the carrier, the disappearance of superheat and extra latent heat in the original vapor. If the carrier is dry at the inlet, the coefficient reduces to that of convection, h_c, between the carrier gas and the surface. For dry gas, $h = h_c$.

Equation (3) shows that if the wet-bulb conditions are independent of velocity and evaporation surface then, although K and h individually vary with these factors, their ratio does not. The ratio depends solely on the conditions of the mixture in the manner determined by Equation (3) which, in the case of air-water vapor mixtures, becomes:

$$\frac{h}{K} = L_s \frac{w_s - w}{t - t_s} \qquad (4)$$

In the light of Equation (2) defining t_s

$$\frac{h}{K} = \frac{0.24}{1 - \dfrac{0.48(t - t')w + (L' - L_s)w}{L_s\,(w_s - w)}} \qquad (5)$$

The fraction in the denominator is the ratio between the heat in the vapor and the heat required for vaporization. This ratio tends toward a definite limit function of t_s as inlet conditions approach saturation. For instance, if $t_s = 86$ deg. F., the limit is 0.15.

If instead of using the exact Equation (2) we use the approximate one:

$$0.24\,(t - t_s) + 0.48\,(t - t_s)\,w = L_s\,(w_s - w) \qquad (6)$$

we have the approximate relation independent of t often found in the literature[1]:

$$\frac{h}{K} = 0.24 + 0.48\,w \qquad (6a)$$

in which h and $(0.24 + 0.48w)$ are respectively the coefficient of convection and the specific heat of the humid mixture.

For dry air, both the exact and approximate relations reduce to:

$$\frac{h_c}{K} = 0.24 \qquad (7)$$

Elimination of K between Equations (7) and (5) gives the relation between h and h_c:

$$h = \frac{h_c}{1 - \dfrac{0.48(t - t')w + (L' - L_s)w}{L_s\,(w_s - w)}} \qquad (8)$$

It is thanks to the constancy of the ratio h/K that radiation effects can be rendered negligible during wet-bulb readings. This is accounted for by the fact that increasing the velocity of flow considerably increases the rate of evaporation, while the amount of heat radiated to the evaporation surface is independent of the air velocity, hence remaining constant so that its percentage effect on the result can be made negligible.

Equation (7) will permit calculation of the coefficient of vapor transfer of a surface is its coefficient independent of the nature of the surface is known, and conversely, the calculation of h_c if K is known.

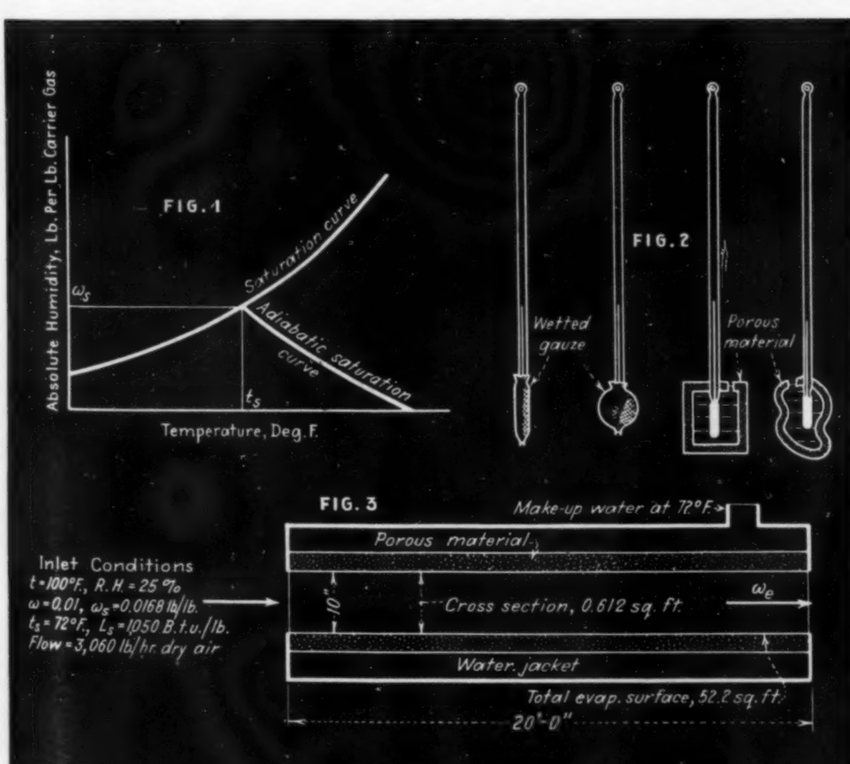
Numerical Example 1—Determine coefficient of evaporation of the humidifier shown in Fig. 3 and the exit absolute humidity resulting from adiabatic humidification for a flow of 3,060 lb. per hr. (dry air basis) when the inlet conditions are 100 deg. F. and 0.01 lb. per lb. abs. humidity (t_s = 72 deg. F., $w_s = 0.0168$).

According to Walker, Lewis and McAdams ("Principles of Chemical Engineering," McGraw-Hill Book Co., Inc.) the coefficient of heat transfer by

Fig. 1—Skeleton psychrometric diagram showing adiabatic saturation line

Fig. 2—Several types of wet bulbs, illustrating independence of wet-bulb temperature of type of wetted surface

Fig. 3—Cylindrical humidifier used to illustrate calculation of coefficient of evaporation



[1] For instance, see Perry's "Chemical Engineers' Handbook," 2d Edition, McGraw-Hill Book Co., Inc. (1941).

convection for gases flowing in pipes is:

$$h_c = 0.22\, c_p\, T_f^{3/5} \frac{V^{0.8}}{D^{0.2}} \qquad (9)$$

in which V is mass velocity (here equal to $3{,}060 \times [(1+0.01)/1] \div (0.612 \times 3{,}600) = 1.4$ lb. per sec. and sq.ft.); D is the inside diameter in inches; T_f is the average absolute temperature in deg. F.; and c_p is the specific heat of the gas in B.t.u. per lb.

In the present case, the average temperature will be about 98 deg. F. (558 deg. abs.) and the coefficient of heat transfer for the considered pipe will be $h_c = 0.22 \times 0.24 \times 558^{\frac{3}{5}}\, 1.4^{0.8}/10^{0.2} = 2.97$ B.t.u. per hr., sq.ft. and deg. F.

From Equation (7), the coefficient of evaporation will therefore be $K = 2.97/0.24 = 12.4$ lb. per hr., sq.ft. and lb. difference in absolute humidity.

The humidification efficiency will be:

$$E = \frac{w_e - w_i}{w_s - w_i} = 1 - e^{-KS/F}$$

$$= 1 - e^{-\frac{12.4 \times 52.2}{3{,}060}} = 0.19$$

and the exit absolute humidity will be given by:

$$\frac{w_e - 0.01}{0.0168 - 0.01} = 0.19$$

whence

$$w_e = 0.01129 \text{ lb. per lb.}$$

From the psychrometric chart the exit temperature will be $t_e = 95$ deg. F. on the 72 deg. F. adiabatic saturation curve.

Numerical Example 2—The following example will illustrate the reverse calculation of h_c when K is known.

Determine the coefficient of heat transfer for 3 in. coke packing.

According to the plot by Sherwood (in Perry's Handbook), showing the results of Whitman and Keats, the coefficient of evaporation for 3-in. coke packing can be expressed by:

$$\frac{K'}{40} = \left(\frac{V}{600}\right)^{0.8} \quad \text{or} \quad K' = 0.238\, V^{0.8}$$

In this relation K' is in pound mols per hr. and cu.ft. of packing per atmosphere of vapor pressure difference. Expressed in lb. per in. of vapor pressure difference, the expression is:

$$K' = 0.000315\, V^{0.8}$$

It can be shown that the relation between K' in lb. per in. and K is:

$$\frac{K}{K'} = \frac{29.92 - p}{0.623 + w_s}$$

in which p is the vapor pressure of the unsaturated mixture in inches. This shows that if K is independent of the inlet conditions, K' is not. In the case under consideration, the plot does not state the inlet conditions to which the coefficient refers so, for the sake of completing the present example, let us assume that it corresponds to dry air at 100 deg. F. ($p = 0$ and $w_s = 0.0102$). Then

$$K = \frac{29.92}{0.623 + 0.0102} \times 0.000315\, V^{0.8}$$

$$= 0.0148\, V^{0.8}$$

and $h_c = 0.24 \times 0.0148\, V^{0.8} = 0.00355\, V^{0.8}$ in B.t.u. per hr., deg. F. and cu.ft. of packing.

The general formula for the coefficient of heat transfer for beds of broken solids determined by C. C. Furnas[2] is more complicated:

$$h_c = A \frac{v^{0.7}\, T^{0.3}\, 10^{(1.68f - 3.56f^2)}}{d^{0.9}}$$

[2] C. C. Furnas, *Trans.* Am. Inst. Chem. Eng., 24, 142 (1930).

In this expression h_c is in B.t.u. per sec., deg. F. and cu.ft. of packing, A is a constant characteristic of the solid and gas, f is the fractional value of voids in the bed, v is the flow in standard cu.ft. per sec. and sq.ft., and d is the particle diameter in ft. The constant A is probably introduced because, in the method of determination, the lag caused by conduction inside the solid is not taken into account.

Dividing the right-hand side by 0.24 will give the general formula for the coefficient of evaporation for broken solids wetted without excess in lb. per sec. and cu.ft. of packing per lb. absolute humidity difference.

Graphical Approach to Leaching Problems

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***Chem. & Met.* INTERPRETATION**

Leaching theory is still inadequate, although by various graphical and analytical methods, satisfactory results can usually be achieved, even though a certain amount of adaptation may be required after the equipment has been put into operation. Our author has worked out a simple graphical approach to leaching problems employing a countercurrent diffusion battery, which enables the problem to be visualized readily and gives a "framework and background" for the calculations, as he expresses it.—*Editors.*

Quite a good discussion of leaching is given in Badger and McCabe's "Elements of Chemical Engineering" (McGraw-Hill Book Co., Inc.). Although, as these authorities state, the theory so far is quite inadequate, analytical and graphical methods have been worked out. In this connection, see an article by Armstrong and Kammermeyer (*Ind. Eng. Chem.*, 34, 1228, Oct. 1942).

Such theory as is available does not make it easy to visualize the problem and a process engineer seeking aid in revising a present layout would probably feel somewhat at a loss. The diagrams given as a part of this article were developed to make the principles evident, and to give a framework and background for the actual calculations.

Assume a battery of closed tanks, as in Fig. 1, through three of which in series it is desired to pump hot water or some other solvent countercurrently. The possibility of pumping also through a fourth tank is being considered. Samples of the solvent can be taken during the cycle, but samples of the solid material being leached cannot be obtained until the tanks are finally opened at the end of the cycle. There is a question how much good is being done during the last hour of operation, and whether a fourth tank in the series would be worthwhile.

DIFFUSION BATTERY OPERATION

In a countercurrent diffusion battery the fresh solvent, which is at zero concentration, goes to the oldest tank first. The flow through one tank equals the flow through each following tank but the concentration increases along the way. Periodically, at intervals, the oldest tank is disconnected and opened up, while a fresh tank is hooked on to the line at the other end. The piping arrangement for doing this has been pretty well standardized.

The curves of Fig. 2 show the rise in concentration of solute in the sol-

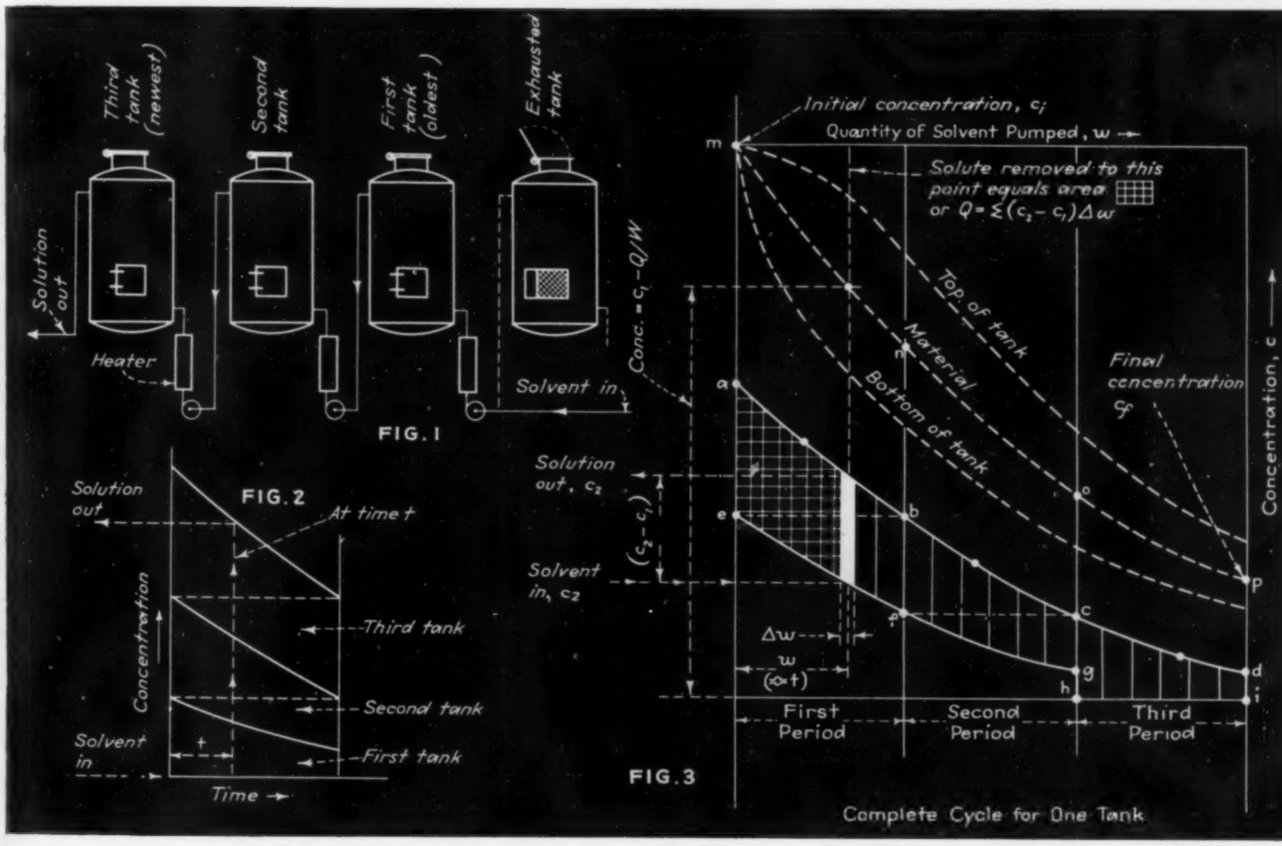

Fig. 1—Countercurrent diffusion battery of three tanks in line, with a fourth tank exhausted, ready for dumping

Fig. 2—Curves for a single cycle of three leaching tanks, showing concentration changes in each tank

Fig. 3—Concentrations of solute in solvent and material during three cycles in a single leaching tank

vent as it flows through the battery of three tanks. Obviously, concentration of the solvent leaving one tank equals the concentration of solvent entering the following tank. If we assume (as is not always the case) upward flow through the tanks, the concentration of solute retained by the material at the top of one tank tends to equal that at the bottom of the following tank. An equivalent statement is true for downward flow.

Fig. 2 was drawn for the variation in concentration of the solvent during a single period of the cycle. The changing concentration in the three tanks is shown for this one period. The curves showing the concentration in the three tanks during one period are also, correctly, the three parts of the curve for one tank through three periods of a cycle. In Fig. 3 let us draw a curve for the concentration of solvent leaving one tank and have it cover the entire cycle for that tank. We will use "concentration" as ordinates for the curve. For the horizontal scale it will be convenient, instead of using "time," to use the quantity of solvent pumped in that time. Then area on the diagram will represent solute removed from the material.

Fig. 3 shows a complete cycle for solvent passing through the tank. Curve *a b c d* shows the concentration leaving the tank at any instant, and Curve *e f g h i* shows the concentration entering the tank. The only data needed for drawing the curves are the concentrations of solvent leaving the one tank through a representative cycle. As the curve will be "smooth," half a dozen data should suffice. They need not be taken at regular intervals. It follows from the hook-up that curve *e f g* is identical with curve *b c d*, merely being displaced horizontally one period to the left.

SIGNIFICANCE OF AREA

Area between the two solvent-concentration curves, summed up to any point, gives the amount of solute removed in the solvent up to the corresponding time. As shown on the chart, this area Q is equal to Σ $(c_2 - c_1)\ \Delta\ w$, where Q is the pounds of solute removed in time t, c_2 and c_1 are the leaving and entering concentrations respectively, and w is the pounds of solvent pumped. It is simple then to figure the concentration of solute remaining in the material and to draw a curve showing average values for this concentration through the cycle. At any point on this curve the concentration of solute remaining in the material is $c_1 - Q/W$, where c_1 is the initial concentration and W is the total pounds of solute initially in the material in the tank. This curve is given as *m n o p* in Fig. 3. It is shown by a dotted line, since it is really only a reference line about which a series of curves can be centered to show concentrations of the solute left in the material at different levels in the tank. Two boundary curves are shown in dotted lines. One curve represents the concentration at the top of the tank and other shows concentration at the bottom.

Concentration is same throughout the tank at the start but (on original assumption of upward flow) concentration at the bottom comes down much faster for a while and tends to equal the value at the top of the tank from which solvent comes. In other words the two boundary curves tend to become identical, with the same horizontal displacement of one period as was observed in the case of the solvent. Incidentally, the area between the boundary curves has no significance.

Consideration of Fig. 3 shows that the practical effect of adding an additional tank in the line is to extend the righthand part of diagram, and in so doing, to accomplish two things with

the same rate of pumping: (1) to extract more of the total solute; and (2) to make the top and bottom of the tank more nearly alike in final concentration.

This discussion has had in mind the revision of an existing set of tanks. So far as its applicability to original design is concerned, the practical value of the method lies in its ability to show graphically the nature of the operation. If one can actually visualize the operation itself, it should be possible to use such theory as is available in designing a system that will work fairly well from the start, even though certain improvements in operation may have to be brought about after putting the equipment into operation.

Relation of Harmonic and Logarithmic Means

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Chem. & Met. INTERPRETATION

The harmonic mean of two quantities, which equals twice their product, divided by their sum, is often met in calculations of engineering quantities. In other cases the log mean is encountered, and sometimes both means together. The author has derived a chart of the relation between the two means, by use of which it is often possible to employ the simpler arithmetic average of variable quantities, producing a correct result by a correction factor taken from the chart.—*Editors.*

THE HARMONIC MEAN of two quantities is defined as twice their product divided by their sum. It may be encountered frequently, as for example in the calculation of the arithmetic average of either of the two variables related as follows.

$$xy = \text{constant} \tag{1}$$

For example, in the study of the flow of fluids the equation of continuity is often used. It has the form:

$$uA\rho = \frac{M}{\theta} \tag{2}$$

where u = linear velocity, A = cross-sectional area of the channel, ρ = density, M = mass and θ = time. Of course M/θ has a fixed value for steady flow. For liquids, ρ normally undergoes only a slight variation so that one may write for this case

$$V_{A.Av.} = \frac{u_1 + u_2}{2} = \frac{M}{2\theta\rho}\left(\frac{1}{A_1} + \frac{1}{A_2}\right) \tag{3}$$

$$= \frac{M}{2\theta\rho}\left(\frac{A_1 + A_2}{A_1 \times A_2}\right) \tag{4}$$

$$= \frac{M}{\theta\rho A_{H.M.}} \tag{5}$$

where $V_{A.Av.}$ denotes the arithmetic average velocity of the fluid, and $A_{H.M.}$ denotes the harmonic mean of the two area values.

The log mean is encountered in many equations relating to flow of energy or of materials. Both the log and harmonic means are encountered in certain equations governing the isothermal behavior of a perfect gas, and it may be advantageous to know the relationship existing between the two means. The following equations demonstrate that whereas the true average pressure depends on the log mean of the terminal volume values, the arithmetic mean pressure is related to the harmonic mean of these volume values.

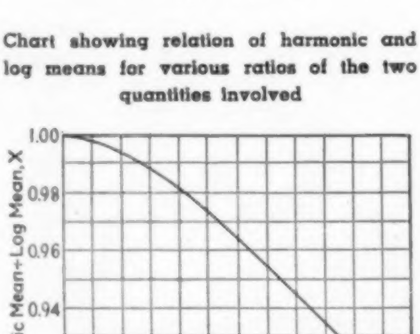
$$\int_{V_1}^{V_2} P dV = n\,R\,T \ln \frac{V_2}{V_1} \tag{6}$$

$$\int_{V_1}^{V_2} P dV = P_{Av.}(V_2 - V_1) \tag{7}$$

Equations (6) and (7) may be solved for $P_{Av.}$ and one obtains

$$P_{Av.} = \frac{n\,R\,T}{V_2 - V_1} \ln \frac{V_2}{V_1} \tag{8}$$

Chart showing relation of harmonic and log means for various ratios of the two quantities involved



$$= \frac{n\,R\,T}{V_{L.M.}} \tag{9}$$

where $V_{L.M.}$ denotes the log mean of the two volume values. If $V_{A.Av.}$ is used to indicate the arithmetic average of the terminal volume values and $V_{H.M.}$ stands for the harmonic mean of these values it can be shown that

$$P_{A.Av.} = \frac{1}{2}\left(\frac{n\,R\,T}{V_1} + \frac{n\,R\,T}{V_2}\right) \tag{10}$$

$$= \frac{n\,R\,T}{V_{H.M.}} \tag{11}$$

In the application of Bernoulli's Theorem to the isothermal flow of perfect gases one encounters the term $\int V dp$, the evaluation of which will serve as another example. By analogy to Equations (6) to (11) inclusive, it may be shown that in this case

$$V_{Av.} = \frac{n\,R\,T}{P_{L.M.}} \tag{12}$$

and

$$V_{A.Av.} = \frac{n\,R\,T}{P_{H.M.}} \tag{13}$$

For the sake of simplifying calculations one may write

$$\int_{P_1}^{P_2} V dp \cong V_{A.Av.}(P_2 - P_1) \tag{14}$$

Equation (14) is good only when P_1 and P_2 do not greatly differ. It may be made accurate by the introduction of a correction factor X which is equal to $V_{Av.}/V_{A.Av.}$

$$\int_{P_1}^{P_2} V dp = V_{A.Av.}(P_2 - P_1)X \tag{15}$$

Inspection of Equations (12) and (13) reveal that

$$X = \frac{P_{H.M.}}{P_{L.M.}} \tag{16}$$

The usage of Equation (14) amounts to equating X to unity, and in general overlooking the difference between the harmonic and log means of the terminal pressures. For this reason a graphical representation of the relation between the two types of means will be given.

Let the quantities in question be designated by A and B, while M_H and M_L will stand for the harmonic and log means respectively.

$$M_H = \frac{2\,AB}{A + B} \tag{17}$$

$$M_L = \frac{A - B}{\ln (A/B)} \tag{18}$$

$$X = \frac{2\,(A/B) \ln (A/B)}{(A/B)^2 - 1} \tag{19}$$

A series of values of (A/B) can be assumed and the corresponding values of X calculated. The accompanying graph shows the relationship existing between these two variables. With the aid of this chart one may easily use Equation (15) for all values of P_1 and P_2 and thereby avoid the usage of the less accurate Equation (14). Since the graph is general one may compare the harmonic and log means of any two quantities.

High-Octane Aviation Gasoline Program Continues to Expand

EDITORIAL STAFF REPORT

Chem. & Met. INTERPRETATION

Development of this country's aviation fighting fuel program since 1941 reveals all the resourcefulness and persistence against obstacles that has always characterized American industrial enterprise. Allied aviators now have enough gasoline as well as high explosives to pry all Germany well off the map, but several times within the past three years mistakes of judgment reached the blue-print stage that, once committed, would have greatly prolonged the war and cost innumerable lives. Herein Mr. Ickes, Petroleum Administrator for War, reveals before the Truman Committee some of the difficulties encountered in realizing the program. At the same time, it is fitting that due credit be given to the Standard Oil Co. of Louisiana, whose Baton Rouge units are among those contributing so much to the aviation gasoline and synthetic rubber programs. These units, recently toured by a number of notables, are shown in the photographs.—*Editors.*

In the spring of 1941 this country was producing only approximately 24,000 barrels of 100-octane gasoline daily. During May of the same year, the Office of Petroleum Coordinator for National Defense was created by the President, and one of the first acts of this office was to set up committees of the oil industry throughout the country to work with the Coordinator on defense undertakings. At that time Mr. Ickes called for a doubling of 100-octane capacity, which would mean 80,000 bbl. daily, since at that time production was only approximately half of the capacity of the industry.

However, the Office of Production Management then held the view that this country was in a comfortable position for the forthcoming 12 or 15 months, or until the summer and fall of 1942. Nevertheless, it recommended that we should increase our facilities for 100-octane production over a period of 18 months by 25 percent. According to that plan, our industry would have been shooting at a capacity of 50,000 bbl. per day by the first of this year!

At the time the Office of Petroleum Coordinator for National Defense was created, the industry had almost twice the 100-octane capacity that was being utilized. Some plants were shut down and some were running at reduced capacity. Naturally, therefore, there was some reluctance on the part of industry to increase its investments in highly specialized equipment necessary to produce this material. It costs about $5,000,000 to build a 100-octane installation of any respectable size, and even in normal times it takes a year or more to complete a plant and get it into large-scale and full operation.

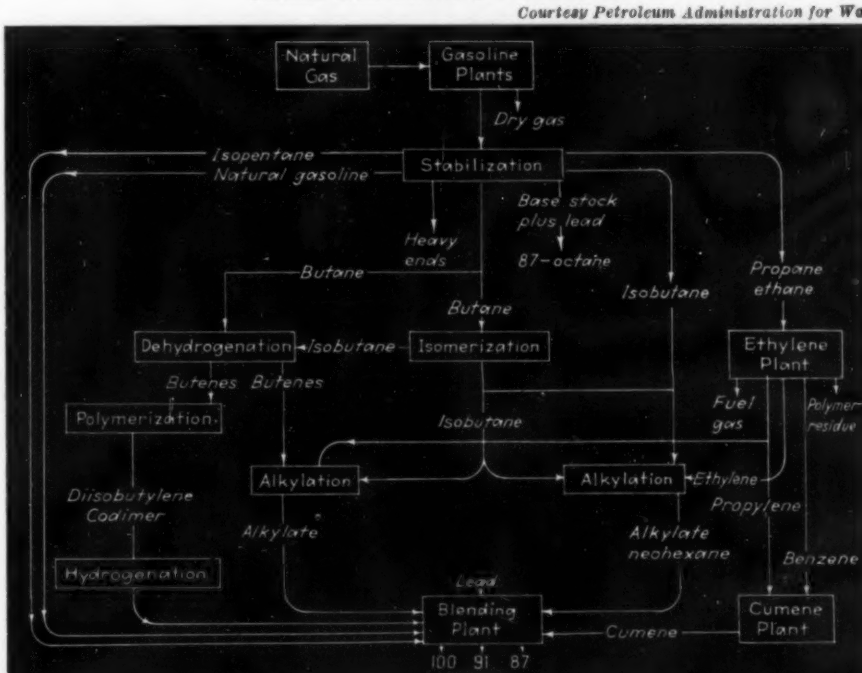
One reason why the petroleum industry was hesitant about a large-scale expansion of 100-octane capacity was that there was no assurance of a market for the product after it was made. The Army and Navy could not, under the law, make contracts for deliveries beyond one year. It would take that long to build the plants and several additional years to amortize the investment.

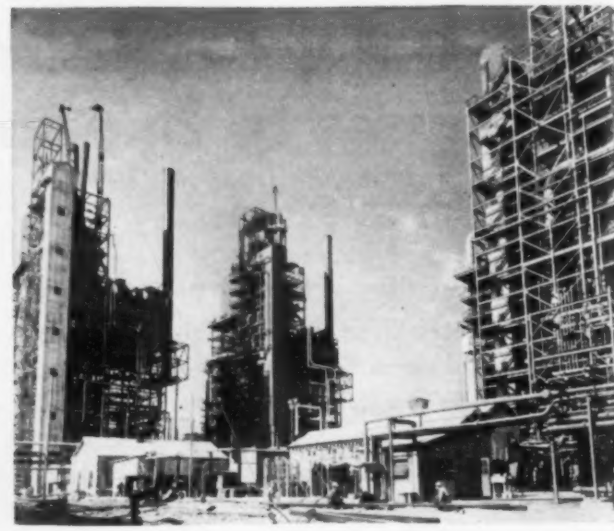
Consequently, in September 1941, the Petroleum Coordinator obtained an informal agreement from Secretary Jones that he would supply financial assistance to build the plants whenever that was necessary and would contract for the purchase of the output. At the same time, instead of nearly doubling capacity, he recommended that it be raised to 120,000 bbl. per day.

From that time until the present, tremendous difficulties have been encountered. The first was that there were only a few refiners in the entire country who knew how to make 100-octane gasoline. The second was that the steel, copper and other materials required for new refinery facilities were

Flow sheet illustrating the processes related to the production of aviation-grade gasoline from natural gas derivatives

Courtesy Petroleum Administration for War





Above—The fluid "cat" cracker at the right, first in this country, has operated at Baton Rouge for a year

Left—Gases processed in this debutanizer and splitter plant are produced by a fluid catalyst cracking unit

critically scarce. The third difficulty was that the refinery engineers estimated that it would take from 12 to 18 months to build the required new units.

In order to overcome in part the last difficulty, a survey of all of the 100-octane plants in the country was made to determine how much they were then producing and to learn whether there might be ways to step up that production. Simultaneously, other refineries were surveyed to ascertain in what ways they could contribute to the program. By November 1941, a comprehensive program was presented to the Supply Priorities and Allocations Board for new plant construction, for additions to existing plants, and for certain changes in refinery operations which would give an immediate increase in production. Before Pearl Harbor, there was also set up the Petroleum Industry Council for National Defense, the first meeting of which was held the day after the bombs fell on Honolulu. This Council then immediately became the Petroleum Industry War Council.

SINCE PEARL HARBOR

What has happened since Pearl Harbor is really amazing. Credit for this can justifiably be equally divided between the petroleum concerns and government officials in charge of the program. Included, of course, is how the oil companies agreed to pool patents and processes that had been worked out over many years at huge expense; how the experts of the Office of the Petroleum Coordinator and of the industry literally wrought magic in squeezing out two barrels of 100-octane gasoline where only one had flowed before; how rival companies shared their raw materials, their blending agents, their facilities and their knowledge.

Success was attained notwithstanding a lack of understanding by many persons in high authority, despite a frightening drain by the armed forces upon the technical talent of the industry, and in spite of the fact that the program had to be cleared through many government agencies in competition with other pressing programs.

It was only in October 1941, that those in authority agreed to the doubling of the productive capacity of aviation gasoline to some 80,000 bbl. daily. In December it was decided to raise the original capacity to 120,000 bbl. daily. A further expansion to 180,000 bbl. was authorized in February 1942, and another to 250,000 bbl. in March of that year. Additional productive capacity was authorized in May.

Official figures of military requirements, meanwhile, had been almost impossible to obtain. It was not until May 1942 that a semi-official estimate showed that by December 1943 the demand for 100-octane would be of the same general order of magnitude as the production that industry had already set out to make. Even this estimate was based on a then-obsolete plane program.

Even in September 1942, the situation was still such that no new official long range figures were available for 1944, and the Office of the Petroleum Coordinator had to make its own unofficial estimate based on information from the Aeronautical Board. This estimate indicated a requirement in 1944 almost double that estimated earlier in the year. Between February and April of this year the indicated requirements rose again sharply. The end is not yet in sight.

The petroleum industry produced during April 1943 more fuel every day than official requirements figures of last July indicated would be necessary. In July of this year it is expected to produce more fuel than the best estimates of a year ago had believed would be necessary by next winter.

However, it takes a year or more to build such plants and the decisions reached now to install new 100-octane facilities cannot have any practical effect until about a year from now. The decisions of a year ago are preventing us from now producing what we could have produced in plants which were properly engineered and which are being properly constructed, but which are coming into production slowly, month by month, rather than with great rapidity, because of failure to provide construction materials to finish them.

Construction materials required for these plants are highly specialized and it is not the absence of cement and lumber which has retarded them. In fact, it is not even the absence of steel plate. The difficulty has been that the apparatus used is extremely intricate, takes a long time to engineer and even today can be built in only a few shops. Those same shops are heavily employed in the Navy program, the Maritime program and the rubber program, as

well as the aviation gasoline program. Until the first of this year, some of the few shops that are capable of fabricating special vessels, catalyst cases, heat exchangers, instruments and the like were not able to operate at full capacity because they had been cut down to the use of only a certain percent of the materials they were capable of handling.

Failure to receive parts for the new plants constituted a very serious setback and, roughly, only a minor portion of the new facilities planned to be in operation by the first of January 1943 were completed. Nevertheless, real production in January was in excess of the target that had been set for only eight months before. The 100-octane gasoline which could not be produced in unfinished new facilities was produced anyway and, in addition, the quality of the product turned over to the armed forces was greatly improved!

This increase in production facilities despite the lack of new capacity was attained by forcing every unit to produce at rates formerly deemed impossible. Judicious use of small amounts of critical construction materials permitted the removal of "bottlenecks" in the plants. Specifications were changed. New ingredients were invented. Some fifty refineries lacking any 100-octane equipment were pressed into service to produce special ingredients. All the refineries were run as one in the sense that ingredients available in all parts of the country were blended in such a way as to gain a maximum number of daily barrels. It is partly by such expedients that the productive goal which had been set only last September is expected to be exceeded in July of this year.

However, some new facilities have been completed, although not as fast as desired. In December 1941, there were operating in the United States and Aruba 23 separate major units rated as 100-octane aviation gasoline facilities. These were substantially complete manufacturing units as distinguished from the approximately 50 peacetime refining units which were called into service later to produce special ingredients.

By July 1942, only one additional such main plant had gone into operation but by December 1942, the total number had increased to 32. By April 25, 1943, this number had risen to 42 and had it not been for the conflict with other programs the number of main units in operation today would be in the general neighborhood of 50. The number is expected to reach 60 before the end of the summer.

DIFFICULTIES IN CONSTRUCTION

Some of the difficulties the industry had to undergo in construction of these new facilities are outlined below:

(1) Steel plate for the new plants was not received until March 1942, and even then it was delivered in a haphazard manner without regard to the needs or relative urgencies of the separate projects;

(2) Although the War Production Board allocated steel plate in May 1942, it did not allocate the other materials at that time because current theories of the board revolved around priorities rather than scheduling:

Companies Manufacturing 100-Octane Gasoline in 1942[1]

Continental Oil Company
Gulf Refining Company
Humble Oil and Refining Company
Magnolia Refining Company
Phillips Petroleum Company
Richfield Oil Company
Shell Eastern Petroleum Company
Shell Union Oil Company
Sinclair Refining Company
Standard Oil Company of California
Standard Oil Company (N. J.)
Standard Oil Company (Indiana)
Standard Oil Company of Louisiana
Standard Oil Company (Ohio)
The Texas Company
Union Oil Company of California

[1] Courtesy Standard Oil Co. (N.J.)

(3) In the summer of 1942, the authorities actually voted the aircraft production program and certain other military programs as of higher urgency than the program to produce fuel for combat planes;

(4) In the early fall of 1942, there was a period of more than a month in which all rubber projects were rated higher than all 100-octane projects;

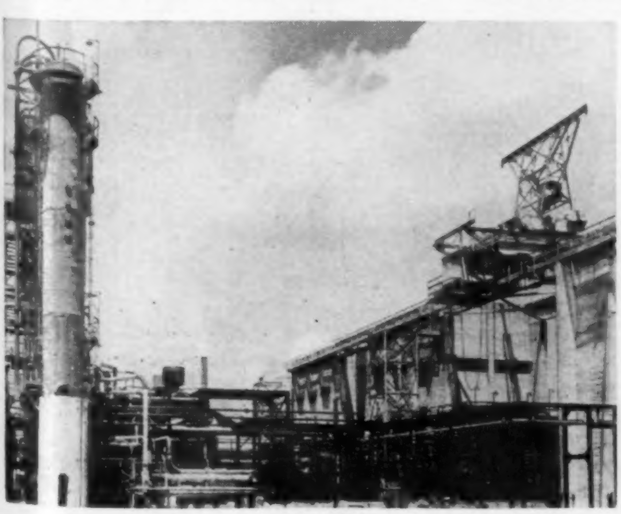
(5) In December 1942, mandatory scheduling of parts for certain plants was finally attained, but the directive which was then issued had to be shared with the rubber program;

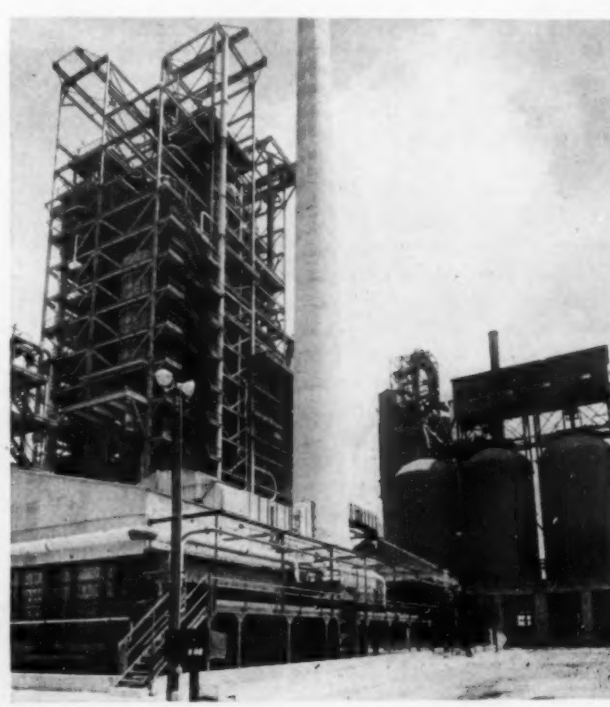
(6) The 100-octane program was denied a similar mandatory directive covering the plants scheduled to be finished in the second quarter of this year, and in addition to failing to receive such help, it suffered a positive hindrance in that the rubber program did receive such a directive.

It was originally estimated by the Office of Petroleum Coordinator for War that this directive to the rubber program and the lack of such a direct-

Right—Fluid "cat" cracker of Standard Oil Co. of Louisiana at its Baton Rouge refinery

Below—Prior to Pearl Harbor this was the largest plant in the world making 100-octane aviation gasoline. It now hydrogenates selective polymer made by 45 other refiners





ive to the 100-octane gasoline program would set back the completion date on some 100,000 daily bbl. of production from plants under construction by some 30 to 90 days. This indicated a probable loss of 9,000,000 bbl. of combat fuel for all time.

Actually, however, results have not been so serious since the directive upon which it was actually based was not as drastic as anticipated. Several other bottlenecks were also broken by joint efforts of engineers. It is now estimated that the preference directive given the rubber program has resulted in the loss of 4,413,600 bbl. of 100-octane aviation gasoline. This is from the rubber directive alone and has no relation to losses suffered as a result of other programs, such as Maritime and Navy.

In conclusion, it is pointed out that it could not be possible tô produce today what is coming from the refineries if the industry had to depend upon critical materials from which new plants could be built. Despite results that are extraordinary indeed, this country is not making as much 100-octane gasoline as it needs: we cannot be satisfied until we are making *more than enough*. However, thanks to the miracles that have been performed by American engineers and chemists, in the petroleum administration and in the industry, the army is going to get the amount of 100-octane gasoline that it requested.

STANDARD OF LOUISIANA

Probably one of the largest plants in this country producing 100-octane aviation gasoline and raw materials for synthetic rubber is the Baton Rouge plant of the Standard Oil Co. of Louisiana.

The hydrogenation plant at this refinery was first put into operation in 1931 to make lubricating oil. Until the entrance of the United States into the war, it is believed that this plant was the largest in the world for manufacture of 100-octane gasoline. The plant is still in operation but its processes have been altered in line with war needs. It is now operating on hydrogenation of di-isobutylene (codimer), which is shipped from other plants. The rest of the hydro capacity is being used for producing high-octane aviation base stocks.

The catalytic cracker at Baton Rouge, put in operation in June, 1942, was the first fluid catalytic cracking unit in the world. Two other units, now under construction, are expected to go into operation in June and in July. These two new units, designed primarily for aviation gasoline and making gaseous and liquid fractions, are of radical and streamlined new design.

In addition, the "cat" crackers produce a great deal more butylene than is obtained from ordinary thermal cracking. This butylene can be alkylated to make blending agents for high-octane fuel or can be dehydrogenated to make butadiene for Buna rubber. They also yield toluene for explosives. Around 33 fluid catalyst units are now in operation or under construction, and these units form the backbone of the aviation gasoline and petroleum rubber programs.

ALKYLATION UNITS

In addition, there are three alkylation units in operation using the butane cut from both "cat" crackers and regular refinery operations. One of the petroleum gases is isobutane; the other may be butylene, amylene or other olefins which are produced in large quantities by fluid crackers. Butylene is also used to make butadiene. The blending agent produced by alkylation is not the same as the synthetic isooctane produced by hydrogenation but has almost as high an octane number. There are several alkylation plants at Baton Rouge in operation for a number of years, all financed by the company.

Also in Baton Rouge is the "refinery conversion" unit which comprises a modification of previously existing thermal cracking equipment. These crack light gas oil at high temperatures to produce a substantial volume of butadiene in the gas stream. In addition to furnishing considerable butadiene for the synthetic rubber program, they are producing substantial quantities of raw material for aviation gasoline.

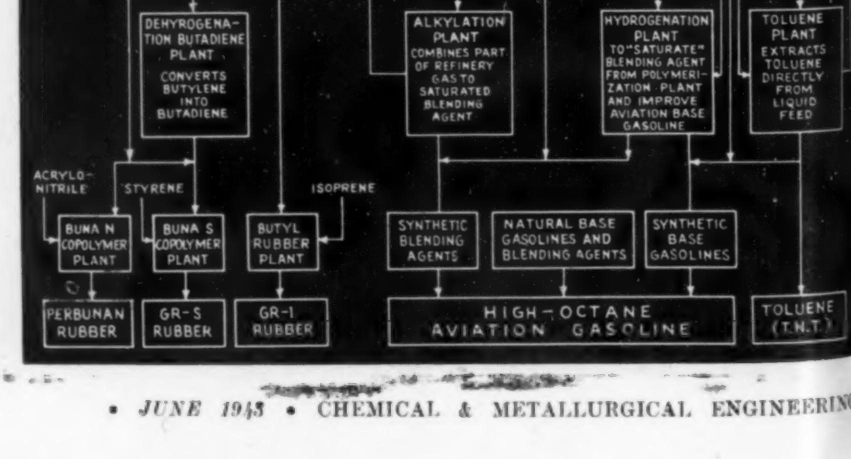
The Standard Oil Co. of Louisiana has invested $38,000,000 in aviation gasoline facilities, none of which is government owned. Exact figures on aviation gasoline may not be revealed at this time, but in comparison to prewar motor gasoline production it would appear that the yield of aviation gasoline is about 20 percent of the crude. Baton Rouge is also operating plants for the production of special blending agents which are even superior to isooctane. The nature of these cannot be disclosed for reasons of national security.

Also of interest is the fact that ethylene is made from certain of the refinery gas streams at Baton Rouge and is an important raw material in the manufacture of tetraethyl lead at the adjacent plant of Ethyl Gasoline Corp. Here a substantial percentage of the country's requirements of tetraethyl lead for use in aviation gasoline is produced.

Other plants located at Baton Rouge include two thermal type butadiene plants, butene dehydrogenation units for butadiene, a Perbunan (Buna N) synthetic rubber plant and a plant for producing Butyl synthetic rubber. These units will be described in a later article which will appear in *Chem. & Met.*

This simplified flow sheet shows the derivation of the three most important war products from cracking plants of the petroleum industry: high-octane aviation gasoline, synthetic rubbers and toluene for T. N. T.

Courtesy Standard Oil of Louisiana

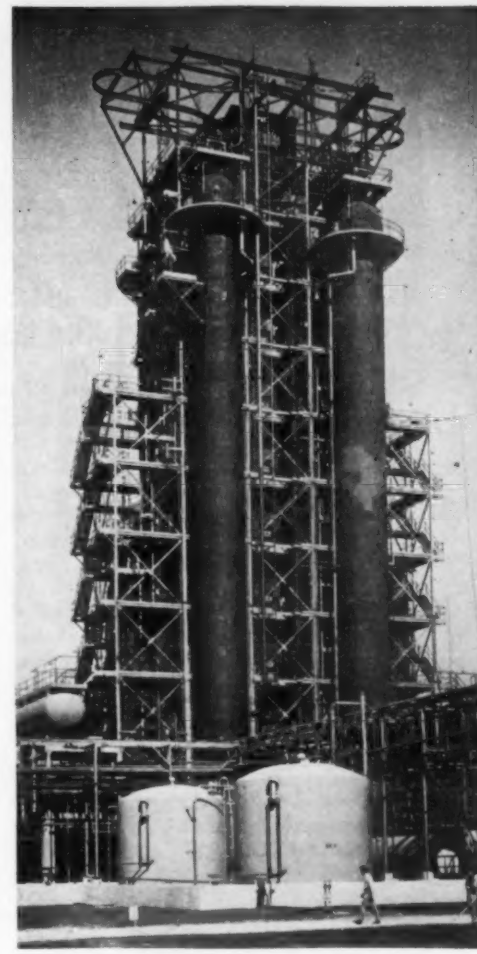


Texas City Styrene Plant Gets Underway

ON November 19, 1941 the Rubber Reserve Co. signed a contract with the Monsanto Chemical Co. to design, build and operate a small plant to produce 3000 tons per year of styrene as part of the synthetic rubber program. In rapid succession the design was changed to increase capacity to 6400 tons, then to 10,000 tons, and in January, 1942, it was revised upward to 20,000 tons. In April it was again doubled and finally in September, 1942, the annual capacity was projected to 50,000 tons.

Basic construction was begun on March 17, 1942, and in seven days less than one year, the huge plant was put into successful operation by Monsanto engineers. Those who had most to do with this project include J. B. Rutter, director of the general engineering department, F. B. Langreck, chief chemical engineer, E. H. Buford, chief design engineer, C. J. Colley, chief power engineer, Ralph W. Booker, chief construction engineer, and Roy W. Sudhoff, assistant director of Monsanto's Central Research Laboratories. A. B. Boyer, former design engineer at the Illinois plant, was called back from retirement for a second time in order to help speed the Texas City program.

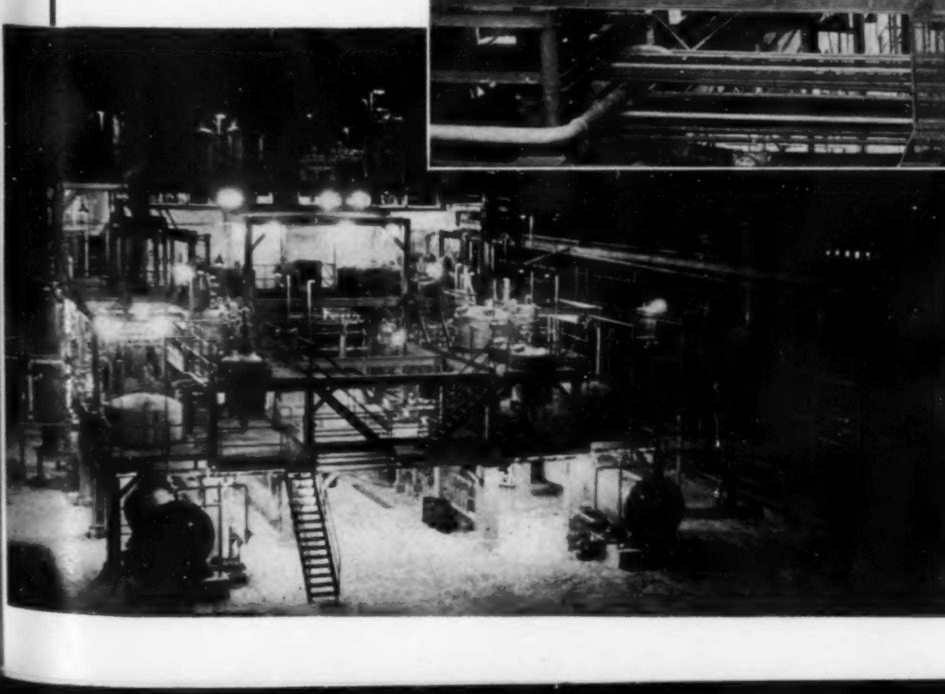
Production of styrene at Texas City is based on propane gas from nearby petroleum refineries and benzol from byproduct coke ovens. The former is cracked to ethylene, then combined with benzene by catalytic alkylation to form ethyl benzene, which is dehydrogenated to produce styrene. In designing and operating the plant, Monsanto has been able to draw not only on its own technical resources but on the technical committee of the Rubber Reserve Co. which provided a free interchange of information with every other company in the field.



Reaching into the sky 20 stories above ground is this distillation column for the recovery and final purification of styrene

Above—Ethyl benzene is dehydrogenated to yield styrene. This $17,000,000 plant went into production in seven days less than a year from the time basic construction was started

Below — Monsanto's plant at Texas City where benzene is alkylated with ethylene produced by cracking propane. Note open-type construction and good illumination



PLANT NOTEBOOK

NEW CHART SIMPLIFIES THE STUDY OF CRUSHING AND SCREENING PROBLEMS

RALPH GIBBS *Consulting Engineer, York, Pa.*

Frequently, in studying closed-circuit crushing and screening problems or operations, many computations are required in making an analysis of the arrangement and sizes of the equipment to be used.

In order to simplify the analysis of such problems, the author has arranged the convenient family of curves shown in Fig. 1.

The fundamental relations used in the development of this simplified group of curves are based on the approximate crushing laws for relatively reciprocating types of crushers, such as the cone, gyratory and jaw, and combining these results with the simple mathematical relations of screening.

The family of lines relating Scales (*A*) and (*B*) are those associated practically with particle sizes produced by crushing. This relation is common for those associated with crushing problems and it shows that 85 percent of the particles produced have a size smaller than that of the crusher opening. It is realized that this is not absolutely accurate for all cases; but for all practical purposes results obtained thereby are highly satisfactory.

Fig. 2 shows a diagrammatic sketch of a simple closed circuit screening and crushing problem as an example.

Example 1—Assume the following conditions exist:

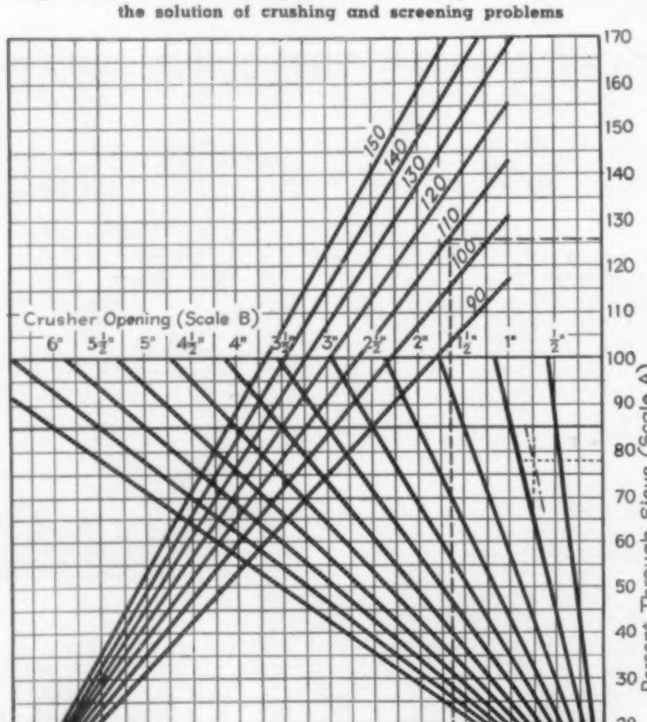
(*a*) The screen has ½-in. openings and is 90 percent efficient in removing this size.

(*b*) 50 tons per hour of minus ½-in. material is wanted.

(*c*) Feed to the screen is 80 percent plus ½-in. in size.

(*d*) The oversize from the screen passes through a crusher set at ½ in.

Fig. 1—Combination crushing-law and screening chart for facilitating the solution of crushing and screening problems



The following terms are used: L_c is the crusher or circulating load, in tons per hour; Q is the incoming feed, in tons per hour; q is the outgoing minus ½-in. material, in tons per hour; A is the percentage of plus screen size in the feed Q; E_s is the percentage screen efficiency; and P_e is the percentage of the crusher product that will pass through a ½-in. sieve.

In this and similar systems equilibrium will be attained when $q = Q$, and to have this condition, the circulating load must be of such magnitude and carrying sufficient "through-screen" particles as to make up the difference between that quantity supplied by the original feed Q and the equilibrium quantity q.

The relations can be shown as follows:

$$L_c = \frac{Q - (1.00 - A)\,QE_s}{E_s\,P_e}$$

$$= \frac{Q\,(1.000 - (1.00 - A)E_s)}{E_s\,P_e}$$

In the example this calculates out as follows:

$$L_c = \frac{50\,(1.000 - (1.00 - 0.80)\,0.90)}{0.90 \times 0.85}$$

$= 53.6$ tons per hour.

The total screen load is $50 + 53.6$ or 103.6 tons per hour and the circulating load in percent of the feed rate is about 107.3.

Referring to Fig. 1, the dashed lines show the solution to the following problem:

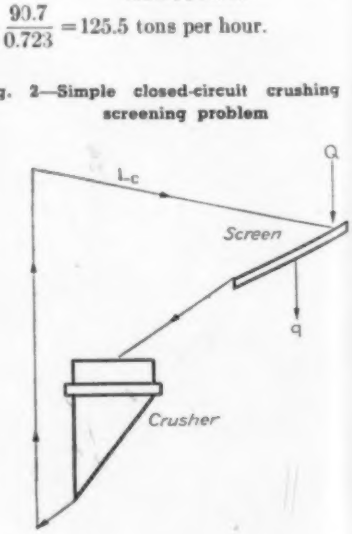
Example 2—The feed has 90 per cent of its pieces larger than ¾ in., which is the desired maximum size. The desired quantity is 100 tons per hour. The crusher is set at 0.825 in. and the screen is 93 per cent efficient.

The computation is made as follows:

$$L_c = \frac{100\,(1.000 - (1.00 - 0.90)\,0.93)}{0.93 \times 0.777}$$

$$= \frac{90.7}{0.723} = 125.5 \text{ tons per hour.}$$

Fig. 2—Simple closed-circuit crushing and screening problem



$P_e = 0.777$ is determined from the crushing law chart as shown by the dotted lines.

In using the proposed curves it is necessary only to locate the vertical dashed line according to the screen efficiency and the plus ¾-in. material in the feed. This line is extended upward until it intersects the proper curve of crusher opening in percentage of fine screen opening or in this case, $0.825 \times 100 \div 0.75 = 110$ per cent.

In most actual screening operations, the problem appears to be more complicated than the simple examples used here. Nevertheless, no matter how involved the screening and crushing arrangement may be, the chart can be used just so long as the process is of the closed circuit variety.

Measurement of Wet-Bulb Temperatures Below Freezing

J. NEUHOFF *Research Engineer*
Carrier Corp., Syracuse, N. Y.

In a recent series of tests on some low-temperature air conditioning—around 10 deg. F.—it was necessary to determine the air-side capacity of a cold diffuser rather carefully. This involved measuring wet-bulb temperatures within about a tenth of a degree F. It was impossible, because of space limitations, to install and read glass thermometers. A system of wetted thermocouples was used. Furthermore, the heat of body and breath might affect the readings of thermometers, while the thermocouples could be used without exposure to body heat. Also, the opening of doors necessary to get in and out of the room to read thermometers frequently would upset room conditions during the test.

The thermocouples were made up into a grid consisting of several iron-constantan couples in parallel, each of the same size and length wire, balanced to prevent cross currents. All the iron wires were connected together and to an iron wire lead; all of the constantan wires were connected together and to a constantan lead. The iron wires were enameled to prevent rusting. The grids consisted of thermocouples held by a wire frame, the couples being placed 2, 3, or 4 in. apart to form a square in the plane of the frame. The grids were made to fit the cross sections of the air streams, and were placed wherever readings were desired, for example, above and below the coils.

Both dry- and wet-bulb readings were taken. The wet-bulb grids had the couple junctions covered with a small wick, which was wetted and allowed to freeze. The wick used was the same that is used on mercury thermometers, a cotton tubing material similar to the material used for shoelaces, washed with soap to remove all sizing so that it would wet. The material is made by the Diamond Braiding Mills, Chicago Heights, Ill., and is designated as No. 8000 white mercerized braid. It was found necessary to sew the wick in a longitudinal seam in order to have it fit snugly on the thermocouple.

The thermocouples were calibrated against a mercury-in-glass thermometer before using. The e.m.f. developed by the thermocouples was measured by means of a slidewire potentiometer, using a sensitive mirror galvanometer. The slidewire itself was mounted on a meter stick and the resistances of the system were adjusted so that 1 cm. movement of the slide along the wire represented 1 deg. F., and so that the reading in centimeters gave the temperature in degrees—thus, the 10 cm. position indicated 10 deg. F. An ice and water mixture in a vacuum flask was used as the reference junction. During operation the system was calibrated continually by checking a thermocouple in the cold room against a mercury thermometer hung next to it, both in an open vacuum flask, to prevent any radiation effect.

Since the potentiometer was located outside the room, readings could be taken in comfort and room conditions were not upset by opening doors. It was only necessary to enter the room to read the calibration thermometer and to wet the wet-bulb wicks. The latter would stay wet (frozen) for from 15 minutes to half an hour, or longer, depending upon the amount of ice deposited. However, for conditions where temperatures are changing, it is wise to prevent too much ice from forming on the wick, as the thermal inertia which would result might affect the readings.

Fig. 1 is a schematic diagram of the slidewire potentiometer used. The slidewire itself was a piece of 22 ga. (0.025-in.) Nichrome wire, mounted on a meter stick. For convenience in reading, the meter stick was cut in two at the 32 cm. mark, and the lower half then fastened at the opposite end, so the stick would read from 32 to 132 cm. Another scale, from 32 to —68, was lettered on the side of the stick, to be used for temperatures below 32 deg. F. Since the reference junction was always at 32 deg. F., temperatures above 32 at the couple being tested would produce currents in opposite direction from temperatures below 32, so a double-pole, double-throw switch was used to reverse the polarity when necessary. A double-pole gang switch was used so that several thermocouples could be measured without having to connect any wires during the test.

To calibrate the system, the slide was set at the point corresponding to the known temperature of the calibration couple. Then, with the gang switch set on the calibration couple, the variable resistor was adjusted until the galvanometer indicated no current flowing. For example, if the calibration couple were in a temperature of 0 deg. F., the slide was set at 0 and the resistor adjusted until the galvanometer showed no deflection. Then the e.m.f. represented by the drop along the slidewire from 32 to 0 just balanced the e.m.f. developed by the couple. Assuming the e.m.f. is directly proportional to temperature—and this is very nearly correct within the range involved—the slidewire will then read temperatures directly. It is wise, however, to have the calibration couple at approximately the same temperature as the temperature to be measured.

Fig. 1—Diagram of potentiometer for determining temperature of wet- and dry-bulb thermocouples above or below freezing

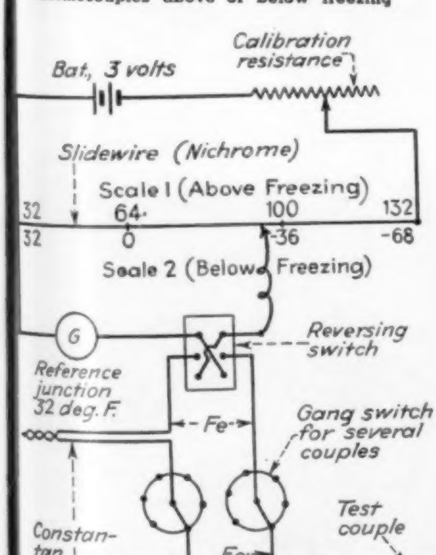
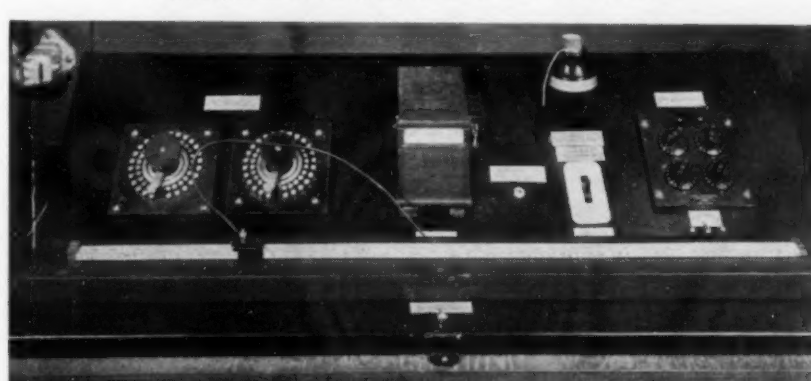


Fig. 2—View of potentiometer and associated apparatus, showing slidewire, temperature scales, galvanometer, gang switches and other elements



PROCESS EQUIPMENT NEWS

Electric Filter Closer

AUTOMATIC opening and closing of one or several filter presses is possible with a new motor-operated hydraulic pumping unit for filter press operation which has been announced by T. Shriver & Co., 810 Hamilton St., Harrison, N. J. The new unit provides for much quicker closing than other types of hydraulic devices for filter presses, according to the manufacturer. Push-button control can be provided at each filter press, or a single control can be used for operating several filter presses. Closing and tightening are accomplished in about one minute. No hand labor for tightening is required, thus reducing the overall time for preparing the filter press for work. A special arrangement on the follower of the filter press permits pushing plates and frames back against the head. A simple weight drawback can be employed, or hydraulic drawback of the ram can be furnished, if desired. The system is applicable to existing filter presses. It consists of a rotary hydraulic pump with suction control, a low pressure rotary pump for automatically increasing capacity at low working pressures, a motor, oil reservoir and the necessary connections and valves between the reservoir and the pump. The entire unit occupies a space only 40x14x39 in. high.

New Proportioning Pumps

Two NEW TYPES of proportioning pumps have recently been added to the existing line of equipment manufactured by Proportioneers, Inc., Providence, R. I. One is a new series of Midget Adjust-O-Feeders available in both diaphragm and plunger types. The former type is built in capacities from 0 to 7½ g.p.h. for pressures to 100 lb.; the latter type in capacities from 0 to 10 g.p.h. for pressures depending on the cylinder material used. Pumps equipped with plastic cylinders are capable of discharge pressures from zero to 150 lb., while with stainless steel or iron cylinders, the pressures may be as high as 1,000 lb. These pumps feature a straight-through shaft which permits coupling as many as eight units to a single motor. The unit employs a fully-inclosed supporting frame which protects moving parts from dust and dirt and eliminates the necessity of guards. Plunger types are equipped with this company's liquid-sealed stuffing gland.

This company has also developed a new large-size proportioning pump for handling regular and off-grade latex, as well as other viscous liquids. A special double stuffing gland contains metallic stripper rings for keeping the material handled out of the packing. Large, easily removable inspection ports are provided for ready inspection of the 3½-in. diameter ball check valves, without the use of special tools. Liquid sealing is provided for the displacement plunger and stuffing gland, and provision can be made for water washing of the plunger as it moves through the stuffing box. This pump is available in both single and duplex construction, in sizes up to and including 30 g.p.m. at 40 r.p.m.

Electronic Variable Drive

A RECENT development of Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., is an adjustable-speed electronic motor drive which provides a 20 to 1 speed range and features automatic acceleration and deceleration. The flexibility of a direct-current motor drive, with an alternating-current supply, is obtained, since the incoming a.c. power is converted by grid-controlled rectifier tubes and supplied to the armature and field of a d.c. motor. The new drive gives an infinite number of speeds within the available range, provides constant torque at all speeds up to the base speed, and constant horsepower above the base speed.

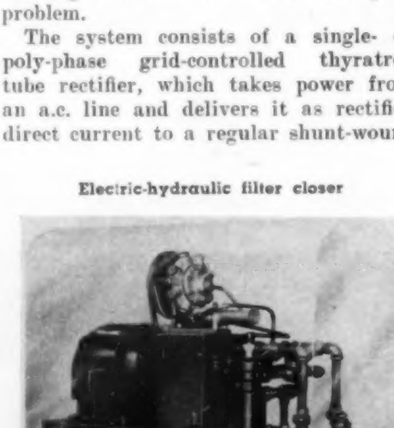
The new electronic drive, known as the Mot-O-Trol, has been designed to fill the desired requirements of an a.c. adjustable-speed motor. The basic idea is not new, since the manufacturer has furnished such drives on special applications for several years. However, recent refinements have been developed which are said to make the new electronic system comparable to or better than other existing solutions to the variable speed problem.

The system consists of a single- or poly-phase grid-controlled thyratron tube rectifier, which takes power from an a.c. line and delivers it as rectified direct current to a regular shunt-wound d.c. motor. The d.c. voltage may be varied from zero to the motor rated voltage (or above) for d.c. armature control. Smaller thyratron tubes are used to provide rectified d.c. field current for the motor. The field voltage is held constant throughout the range of armature voltage, and then is reduced to provide greater speed range by field weakening above the base speed of the motor. The equipment necessary includes a power transformer, electronic control, control station and d.c. motor. A dynamic braking resistor is provided for quick stopping of the motor.

Among the suggested applications for the new drive are the driving of conveyors and feeders in cement and chemical industries, lathes in the ceramic industry, and glass drawing machinery. Rubber tubing machinery and many sorts of paper industry machinery are also suggested applications.

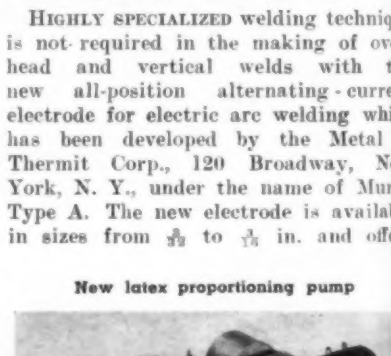
A.C. Welding Electrode

HIGHLY SPECIALIZED welding technique is not required in the making of overhead and vertical welds with the new all-position alternating-current electrode for electric arc welding which has been developed by the Metal & Thermit Corp., 120 Broadway, New York, N. Y., under the name of Murex Type A. The new electrode is available in sizes from $\frac{3}{32}$ to $\frac{3}{16}$ in. and offers

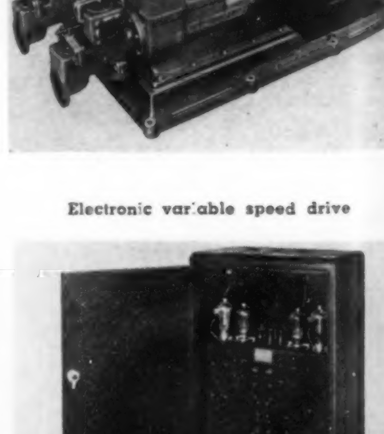


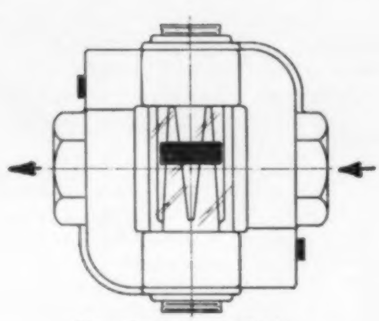
Electric-hydraulic filter closer

New latex proportioning pump

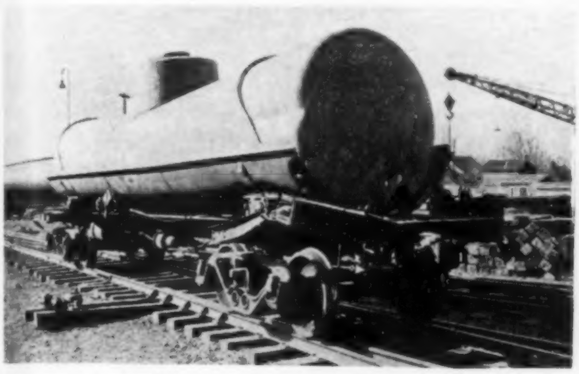


Electronic variable speed drive



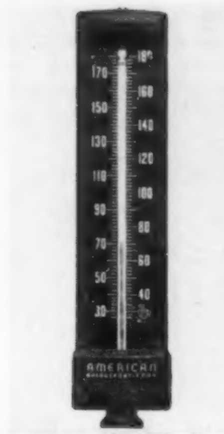


New flow rate indicator



Welded Tank Car Survives Crash

As proof of the ability of all-welded tank cars to withstand railroad accidents, American Car & Foundry Co., builders of the car, point to the record of the car shown here. This 8,000 gal., class ICC-103-W single-compartment welded tank car was severely crushed in a railroad collision which sent the car hurtling down an embankment. When the car rolled over, the dome was caved in and the main head badly deformed. Retesting of the tank before repairs revealed not the slightest leak in any welded seam. The testing, which was carried out before the car was photographed, straightened it out somewhat, but the view gives a good idea of the damage. The tank was originally fusion welded by the Unionmelt process.



Improved industrial thermometer

Volatile liquid pump

typical physical properties of the weld metal such as 52,000 to 61,000 lb. per sq.in. yield point; 62,000 to 71,000 lb. per sq.in. ultimate tensile strength; and 22 to 26 percent elongation in 2 in.

Flow Rate Indicator

SIMPLICITY of construction and low cost are important features of the new Rota-Sight flow rate indicator recently introduced by Fischer & Porter Co., Hatboro, Pa. The new device operates on a principle similar to that of other area meters such as the rotameter but is considerably simplified as compared with meters intended for precise flow rate indication. The function of this device is to show when liquid is passing through a line and, in addition, to give an approximate indication of the flow rate. The device consists of a Pyrex glass tube into which triangular flutes, similar to the V-ports of a valve disk, have been formed. The inner sections of the tube between the flutes are arcs of a circle into which a cylindrical float fits with sufficient clearance to allow it to move without binding. It is said to be possible to see the float readily even when the liquid handled is opaque. The tube is only 3 in. long and is supported within a frame formed from two identical universal fittings, permitting the entering and leaving pipes to be connected to the device in any one of several different ways. Rota-Sights are made in sizes from $\frac{1}{4}$ to $2\frac{1}{2}$ in., for maximum flow rate on water from 4 g.p.m. to 57 g.p.m., the corresponding flow rates on air being 7.5 c.f.m. and 130 c.f.m. If desired, this device may be provided with a magnetic extension which trips an external magnetic switch to operate an alarm circuit for high or low flow rates.

Volatile-Liquid Pump

DESIGNED PRIMARILY for aviation refueling systems, a new line of deep-well, turbine-type pumps has been announced by the Deming Co., Salem, Ohio, for industrial uses as well. These pumps are intended primarily for the handling of hydrocarbon liquids, particularly those of volatile character, and are regularly equipped for explosive-atmosphere service, either with explosion-proof vertical motors, or with a right-angle drive for connecting to a driving unit which may be installed in a separate room.

Advantages of the new pump include elimination of priming difficulties, low installation costs, minimum floor space requirements, high efficiency, low operating cost and freedom from lubrication difficulties. Pumps of this type are lubricated only by the liquids being pumped, requiring no other lubricant. They are available in capacities for gasoline and fuel oil up to 1,000 g.p.m., against ordinarily encountered head pressures in refueling systems. Higher capacities can be had at slightly reduced pressure. Impellers are easily adjustable for changes in capacity or to compensate for eventual wear after long service. The pumps are claimed to be self-venting and incapable of becoming vapor-locked. Instant delivery of liquid is said to be assured, regardless of temperature conditions.

Industrial Thermometer

AN IMPROVED glass industrial thermometer is now being manufactured by American Schaeffer & Budenberg Instrument Division of Manning, Maxwell & Moore, Inc., Bridgeport, Conn. The manufacturer claims all major design improvements accumulated in recent years have been incorporated in this model. It is constructed to permit back, side or oblique angle mounting without the use of a ball joint. Scales and tubes are located for greatest readability, while a new method of scale marking is said to improve legibility. A practically corrosion-proof case is employed which is provided with a black suede finish. The scale is black with yellow figures while the tube is of the red-reading mercury type.

Glass Column Packing

ANNOUNCEMENT has been made by Owens-Corning Fiberglas Corp., Toledo, Ohio, of the successful use of glass fibers as a packing material for rectifying columns used in the production of 190-proof ethyl alcohol by the beverage distilling industry. Glass fibers, according to the manufacturer, may be used as an alternate for both bubble plates and various rigid types of tower packing. The result of the use of this material is claimed to be an increase in capacity owing to the increase in exposed surface area presented by these fibers, as compared with that of either bubble plates or rigid packing.

One method of use of glass fibers is to place them in large expanded-metal baskets which fit, one over the other, into the inside of the column. When used at their normal density of 3.5 lb. per cu.ft., the fibers present 135 sq.ft. of exposed surface per cubic foot, compared with an exposed surface area of 56 sq.ft. per cu.ft. when raschig rings are used. Rectifying columns are now being built with the shell constructed of such materials as clay tile, cypress staves and steel plate salvaged from discarded tanks.

Rubber-Saving Drive

POSSIBILITY of saving as much as 250,000 lb. of crude rubber during 1943 through a slight change in the design of multiple V-belt drives is suggested by Walter Geist, president of Allis-Chalmers Mfg. Co., Milwaukee, Wis. The program suggested by Mr. Geist calls for

wartime drives using shorter center distances and larger sheaves on all new applications made this year. It is pointed out that engineering of individual V-belt drives in the past has been governed largely by such considerations as convenience, habit and machine design. In order to save considerable amounts of rubber, however, it is only necessary to employ higher belt speeds, thus permitting a smaller number of belts to be used to transmit the same horsepower. This can be accomplished by using larger diameter sheaves which of course can be chosen to give the same ratio between driving and driven sheaves, but have the higher peripheral speed required to increase the belt speed as desired. An incidental point is that the larger diameter sheave is not necessarily heavier or more expensive since it has fewer grooves. In fact, in some cases it will be lighter and less expensive. The new system must, of course, be applied with judgment, employing belt speeds not over 5,000 feet per minute so as to avoid slippage due to centrifugal force. Properly engineered, such drives are claimed to be an improvement and not simply a wartime expedient.

Shovel Scoop Truck

TYPICAL of the new devices being developed by Towmotor Corp., Cleveland, Ohio, for attachment to standard lift trucks is the new shovel-type scoop shown in an accompanying illustration. This can be exchanged with standard parts to permit picking up, carrying and dumping all types of loose bulk material. The new scoop is available in capacities from 8 to 25 cu.ft. and can be used for handling bulk chemicals, ores, glass scrap and similar materials. The scoop is manually controlled to pick up or dump material at any point within the lift range.

Plastic-Covered Rolls

AN ACCOMPANYING ILLUSTRATION shows a new type of plastic-covered roll of "Shaf-Tite" construction, recently developed by Rodney Hunt Machine Co., Orange, Mass. The roll illustrated is about 5½ in. in diameter. It is of metal, the surfaces of the roll body being covered with a plastic which provides a hard, smooth, glass-like surface which is said to be unaffected by most acids and alkalies. It is offered for use where exposed iron and steel are objectionable and where a hard, smooth surface is desirable.

Seamless Plastic Tubing

SEAMLESS PLASTIC TUBING in all diameters up to 2 in. O.D. is now available from Extruded Plastics, Inc., Norwalk, Conn., extruded from Tennessee Eastman cellulose acetate butyrate. The new material is known as Tulox TT. Shortly the manufacturer expects to extend the range to 2½ in. O.D. to meet all requirements for war production. The material is available from stocks at the warehouses of concerns such as the Crane Co., Chicago, and Julius Blum & Co., New York.

Equipment Briefs

ADDING to its line of safety equipment for industry, Davis Emergency Equipment Co., 45 Halleck St., Newark, N. Y., has introduced a new safety extension light which is claimed to prevent the possibility of electric shock to the user, even when the guard is removed. The guard is of heavy fiber and is so designed as to serve as the on-and-off switch. When it is unscrewed the current is automatically cut off. All parts of the device except the actual contacts are made of non-conducting materials. Bulbs may be replaced without tools.

FOR THE WATERPROOFING of brick, cement and concrete, even where hydrostatic pressure is present, Modern Waterproofing Paint Co., 1270 Sixth Ave., New York, N. Y., is now offering a new mineral paint, Aquella, which is said to be suitable for all unpainted interior surfaces of these materials. Two coats applied to a wet wall are said to bond to the wall material and not to flake, peel or blister. This treatment will, according to the manufacturer, render the wall impermeable against capillarization and seepage of water.

AN IMPROVEMENT in removable liners for rotary pumps is incorporated in a new pump recently introduced by Blackmer Pump Co., Grand Rapids, Mich. The pump employs the same swinging vane principle found in all pumps of this concern's line, but the liner design is such that its replacement does not require disturbing either the piping or the drive. It is claimed that a pump can usually be relined and back on the line within half an hour. Capacities range from 20 to 750 g.p.m., with pressures up to 300 lb. per sq. in.

THE NEW SAFETY SIPHON for emptying carboys, developed by T. P. Callahan and recently introduced by Alden Speare's Sons Co. (*Chem. & Met.*, Jan. 1943, page 109), is now available from Central Scientific Co., Chicago, Ill. Being made entirely from Saran, the new siphon is both flexible and extremely strong. A built-in vacuum pump starts the siphon in complete safety.

ANOTHER recent metal-saving plastic application has been announced by Penn Metal Corp. of Pennsylvania, Oregon Ave. and Swanson St., Philadelphia, Pa. This company's new product is a plastic card holder produced from transparent cellulose acetate which is easily affixed to lockers, shelving, doors, etc., for the insertion of a card bearing identifying information. A card size of 3⅛ x 1 in. can be accommodated.

MAX MOSHER, 130 West 42d St., New York, N. Y., has announced development of an automatic feeder control for pulverizing magnesium, which has been installed in a magnesium plant to speed production and safeguard personnel. The control regulates the rate of feed of magnesium shavings to a grinder where the shavings are converted into fine powder. The feeder is housed in a separate building alongside the one where the grinder is located, for reasons of safety. Chips are carried from the feeder through a pipe by air suction. If the rate of feed is too great, the grinder becomes clogged, resulting in the possibility of a burn-out of the grinder motor, but also in a possible explosion due to overheating. With the new control, the operator merely dumps magnesium shavings into the hopper at intervals, the controller maintaining the maximum safe rate of feed at all times.

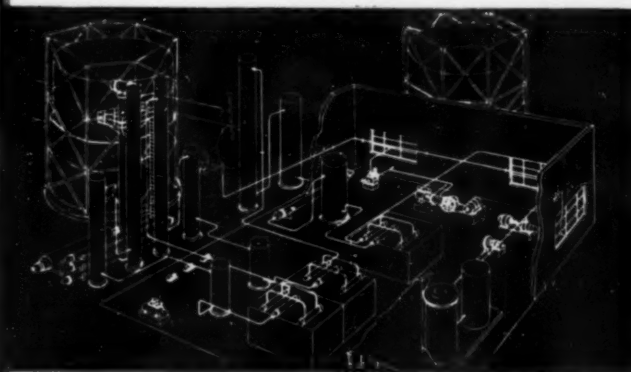
Correction—Through an inadvertence the name of the manufacturer of one of the items described in our New Equipment section for May, 1943, was omitted. The omission occurred in an article on page 151, describing the new eye-protective glass, known as Didymium-Noviweld, which is manufactured by the American Optical Co., Southbridge, Mass. The new glass is intended for use in goggles for protecting the eyes of gas welders.

New scoop for lift trucks

Plastic-covered roll

Cellulose acetate butyrate tubing

The GIRDLER PROCESS *for*



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HYDROCARBONS
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NITROGEN
OXYGEN

and various mixtures.

GIRDLER Process makes Hydrogen at lower cost than any other known method!

LARGE users of hydrogen in the metal industries and chemical fields find the Girdler Hydrogen Manufacturing Process effects large savings in hydrogen gas costs.

With the Girdler process, an abundant supply is assured at all times, for operation is *continuous* and flexible—may be operated from 20% to 100% of the rated capacity. Plant capacities range from 1,000 to 1,000,000 cubic feet of hydrogen gas per hour.

Operating records indicate that when a Girdler Hydrogen Manufacturing Unit replaces an existing process, the Girdler plant often will pay for itself *in less than three years.*

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Production of Buna-S Synthetic Rubber

A *Chem & Met* FLOW SHEET

THE BUNA S RUBBER PLANT of the Defense Plant Corp., at Institute, W. Va., operated by Carbide and Carbon Chemicals Corp. and United States Rubber Co., has a rated capacity of 90,000 long tons a year. The chemicals section is composed of four units for the production of butadiene and two for styrene. The copolymer plant is made up of three units.

Alcohol from storage tanks passes through a series of converters where heat and the action of catalysts convert a portion of it to butadiene. Unreacted alcohol and intermediate products are removed for recycling through the converters in a recovery system consisting of distillation towers and scrubbers. The butadiene is purified by distilling and washing until it is over the 98.5 percent purity specified by the Rubber Reserve Corp. It is stored in pressure tanks. The raw materials required for styrene production are benzol and ethylene. They are passed over a catalyst in an alkylator to form ethylbenzene. The latter is removed from unreacted benzol and byproducts in a series of fractionating columns and held in intermediate storage tanks. This ethylbenzene is fed to a second set of reactors where two hydrogen atoms are removed to form styrene. The latter is purified by distillation and stored.

The copolymer plant is essentially a standard plant built to plans developed by a committee of engineers from four rubber companies. Such ingredients as soap, catalyst, salt, acid and caustic, are delivered to the plant by rail. The butadiene and styrene are delivered by pipeline from the adjacent plant. The process consists of mixing three parts of butadiene and one part of styrene with seven parts of soap solution to form an emulsion. Polymerization takes place in a glass-lined vessel. When it reaches the proper stage, the batch is forced by its own pressure to a blow-down tank where the reaction is arrested. The latex is then passed through flash tanks to remove unreacted butadiene and then through strippers to remove styrene. It is pumped to a large blending tank where several batches are mixed so as to attain uniformity. Latex passes into the creaming tank where brine is added; next into a coagulation tank and then into a soap conversion tank where acid is added and the soap in the rubber changed to fatty acid. The dilute chemical solution is separated on a rotary filter and the crumbs of rubber are washed. A belt conveyor takes them to the disintegrator from which they pass into the dryer. After three passes through the tunnel dryer, the crumbs are compressed into 75-lb. blocks and shipped. (For additional details see article on pp. 98-102.)

CHEMICAL & METALLURGICAL ENGINEERING

June, 1943

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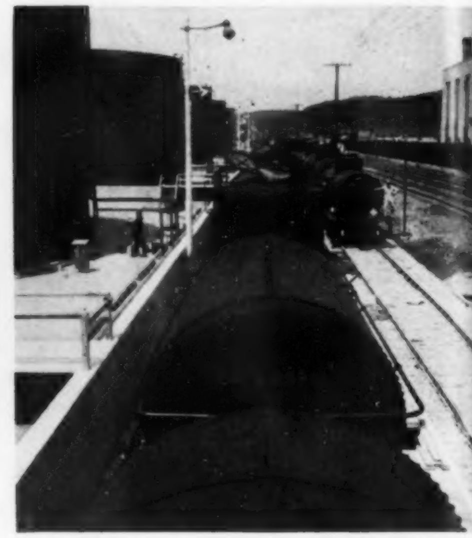
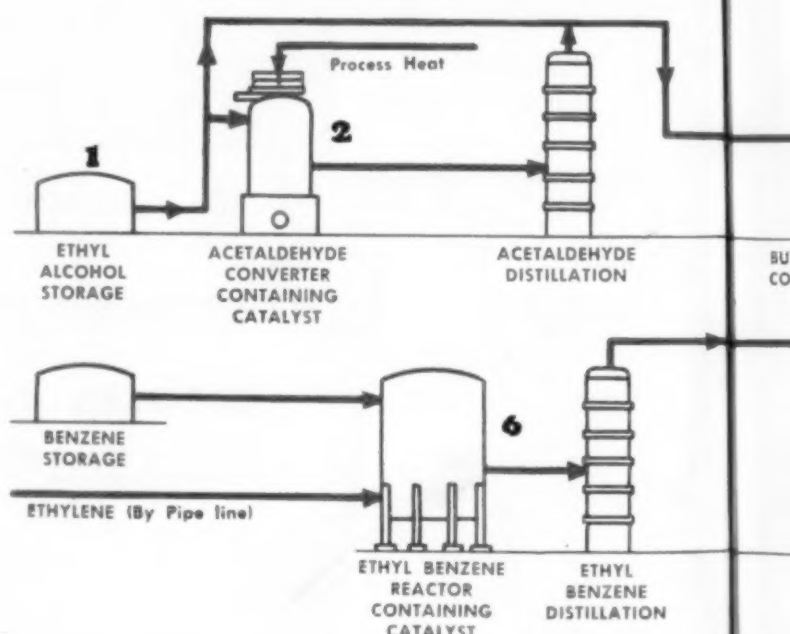
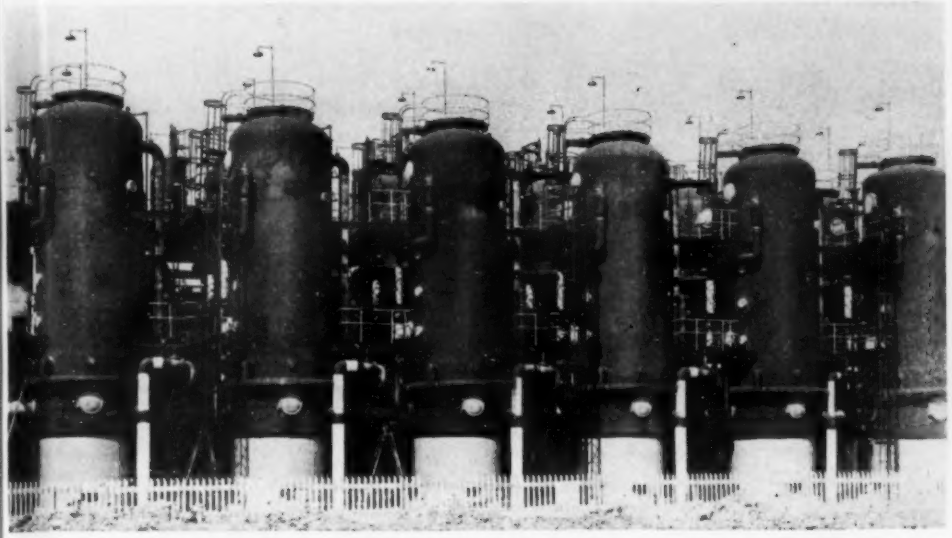


1 Alcohol is shipped to the butadiene plant by tank cars or by barge and is stored in tanks

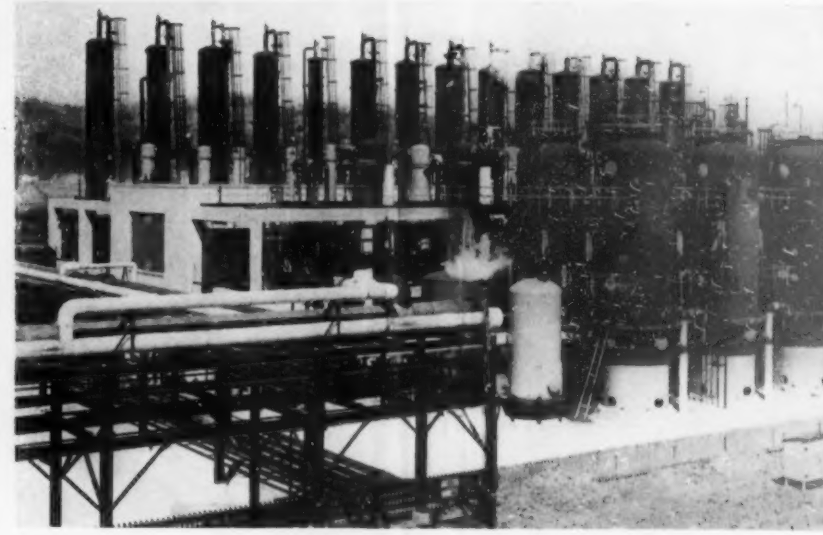


6 Benzol and ethylene are passed over a catalyst in an alkylator to form ethylbenzene which is removed from unreacted benzol

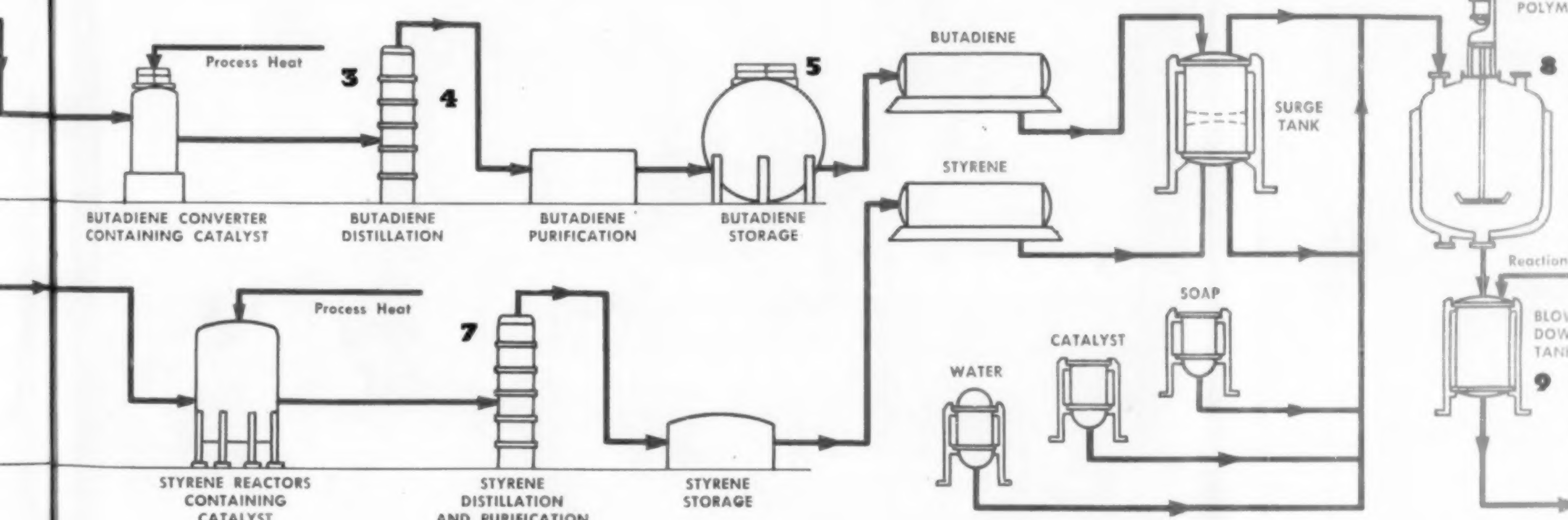
plant
tanks



2 Alcohol passes through converters where by heat and action of catalysis a portion is converted to butadiene. Unreacted alcohol and intermediate products are removed

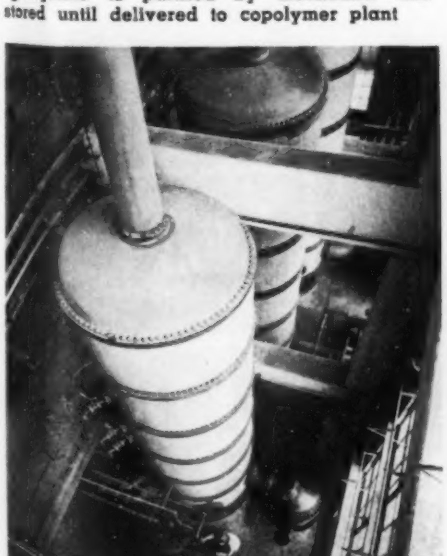


3 Butadiene is purified by distilling and washing until it is over the 98.5 percen purity specified by the Rubber Reserve Co. It is stored in pressure tanks

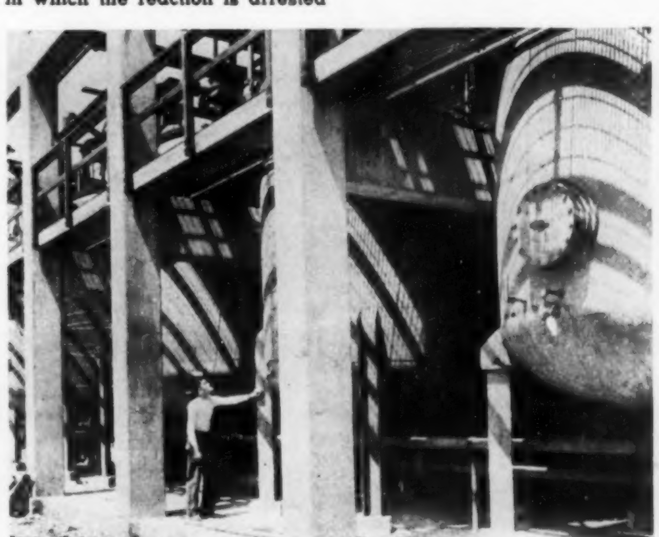


ator

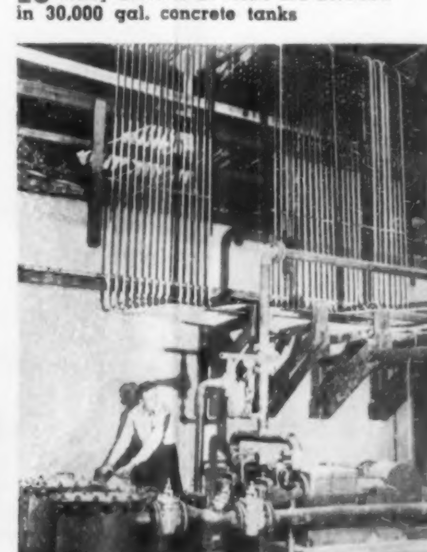
7 Styrene is purified by distillation and stored until delivered to copolymer plant



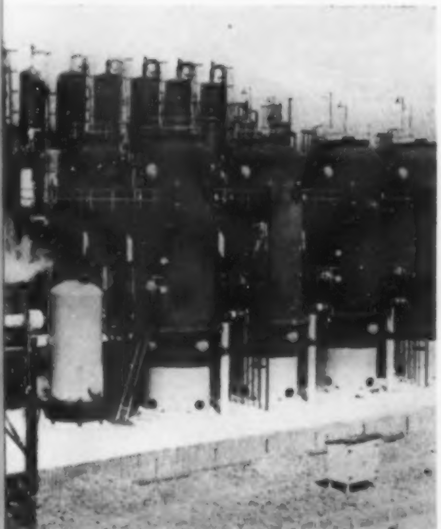
9 The polymerized batch is transferred to blow-down tanks in which the reaction is arrested



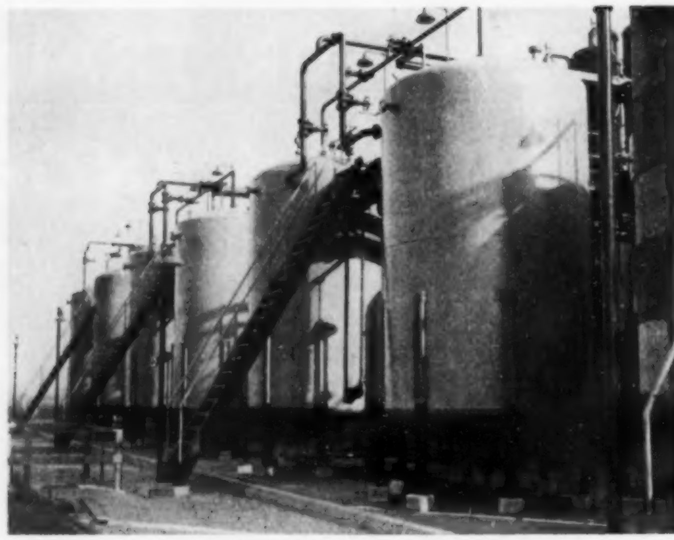
10 Many batches of latex are blended in 30,000 gal. concrete tanks



11 On a rotary rubber washed

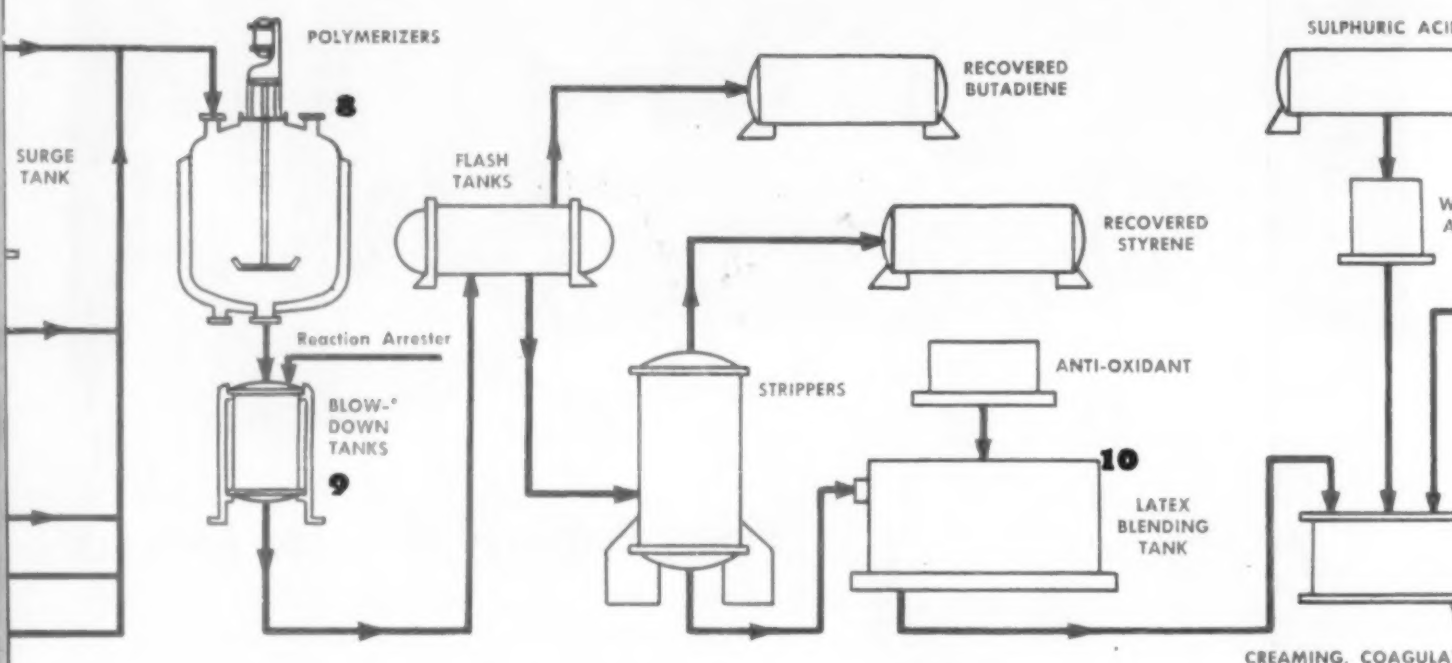


ashing until it is over the 98.5 percent
t is stored in pressure tanks



4 These tanks are used to store temporarily some of the intermediate products from the converters

5 Purified butadiene is st
plant by pipeline. It is me

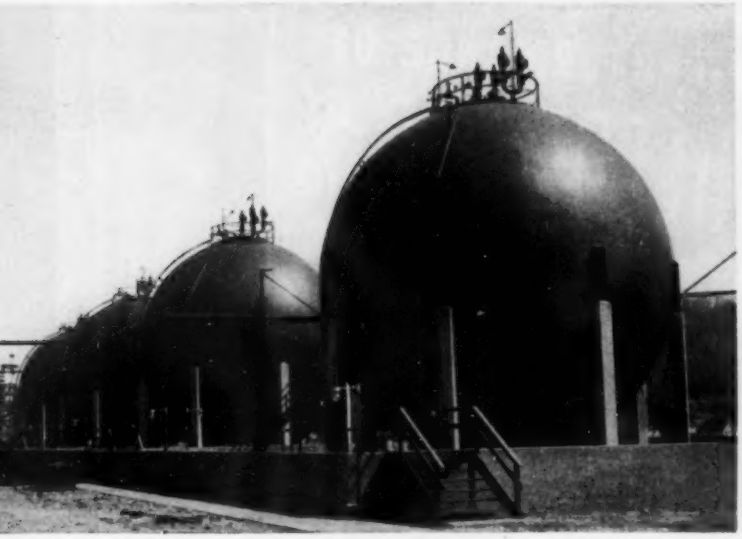


x are blended
anks

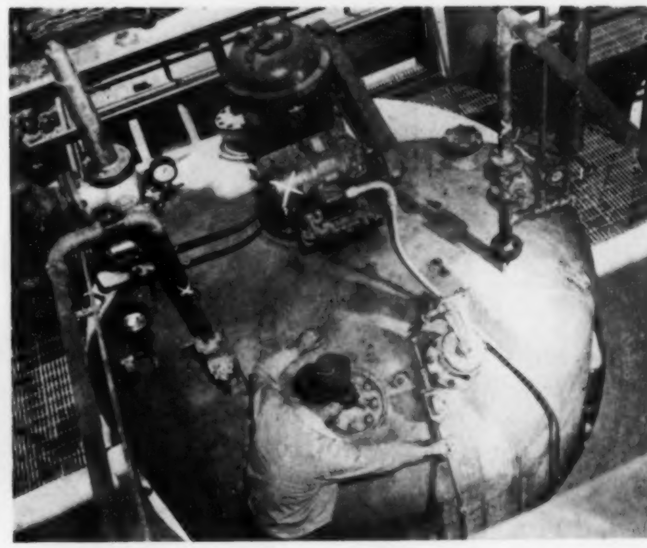
11 On a rotary filter dilute chemicals are separated and rubber washed with fresh water

12 Washed crumbs of rubber, in the form of a blanket, are conveyed on a belt to the disintegrator and dryer

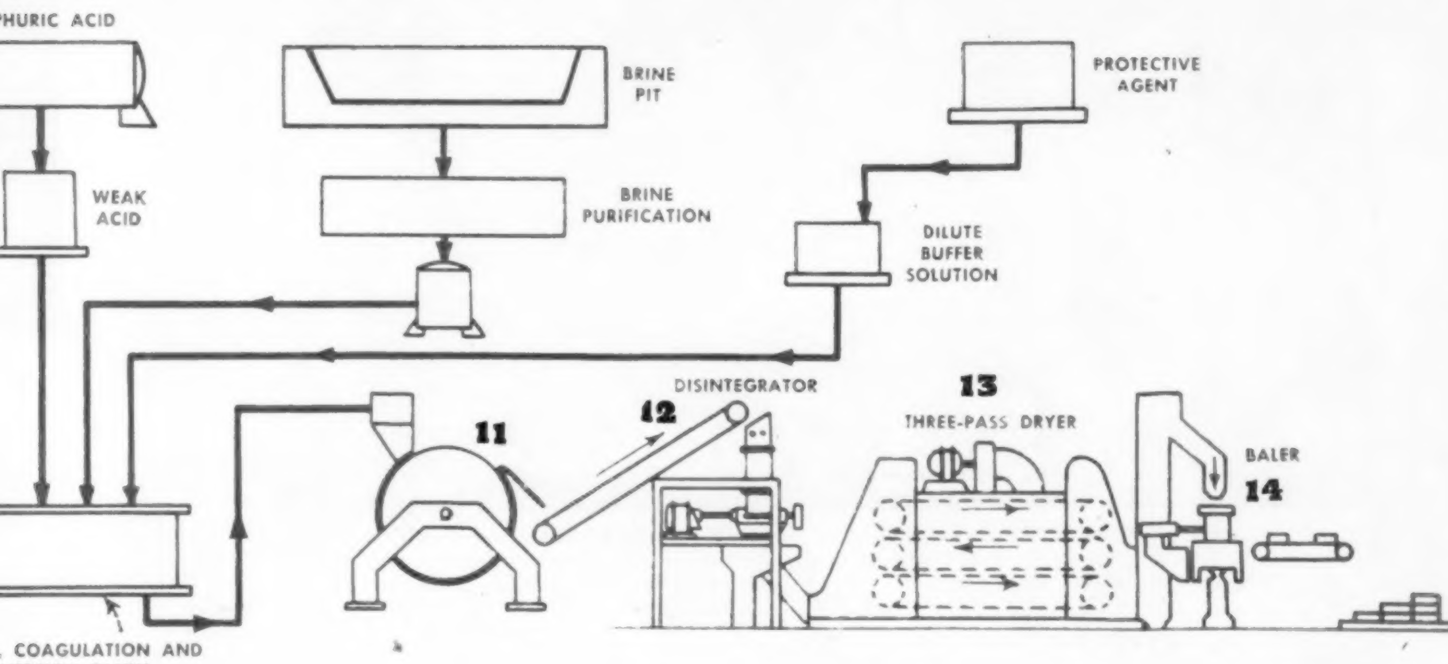
13
It



...tadiene is stored in pressure tanks and is delivered to the copolymer ...ine. It is metered as it passes from chemicals to copolymer plant

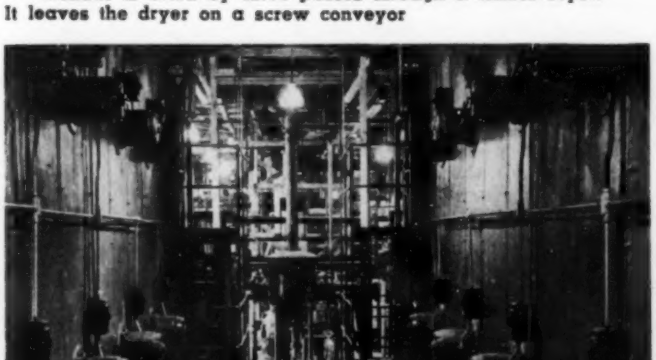


8 Butadiene and styrene are reacted with a catalyst in glass-lined pressure vessels to form the latex



...anket, ... dryer

13 Rubber is dried by three passes through a tunnel dryer. It leaves the dryer on a screw conveyor

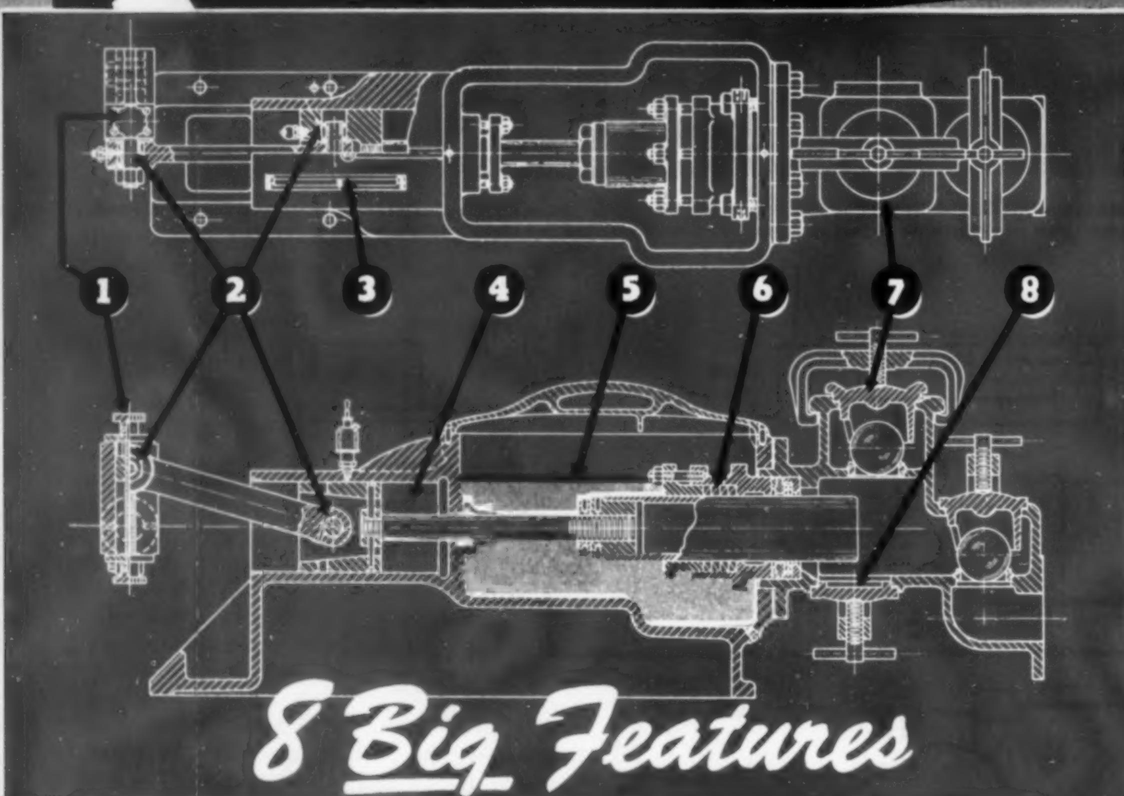


14 Buna S synthetic rubber is pressed into a 75 lb. loaf. The plant will produce 9,000 loaves per day

THE KEY TO THE ACCURACY AND PERFORMANCE OF

% PROPORTIONEERS, INC. %

ADJUST-O-FEEDERS



1 MICROMETER stroke adjustment for exact displacement regulation.

2 NEEDLE BEARINGS with hardened steel races on both crank pin and wrist pin.

3 STROKE INDICATOR scale mounted on cross-head frame shows actual plunger displacement.

4 ACCURATE ALIGNMENT of displacement plunger assured by oversize tubular cross-head guide and piston type cross-head.

5 FLUID SEALED plunger and stuffing gland prevents destruction of frame and working parts by corrosive liquids and of packing by eliminating build-up on plunger from liquids carrying suspended solids.

6 STUFFING GLANDS with lantern rings, liquid seals and "wash" connections,—as well as "stripper" rings when required.

7 SPECIALLY DESIGNED check valves and displacement cylinders.

8 CLEAN OUTS and quickly removable check valve inspection covers for hard-to-handle fluids such as asphalt, latex, slurries, etc.

Specifications, photographs and sectional drawings will be furnished on request. Contact us for "engineering service" on your proportioning problems.

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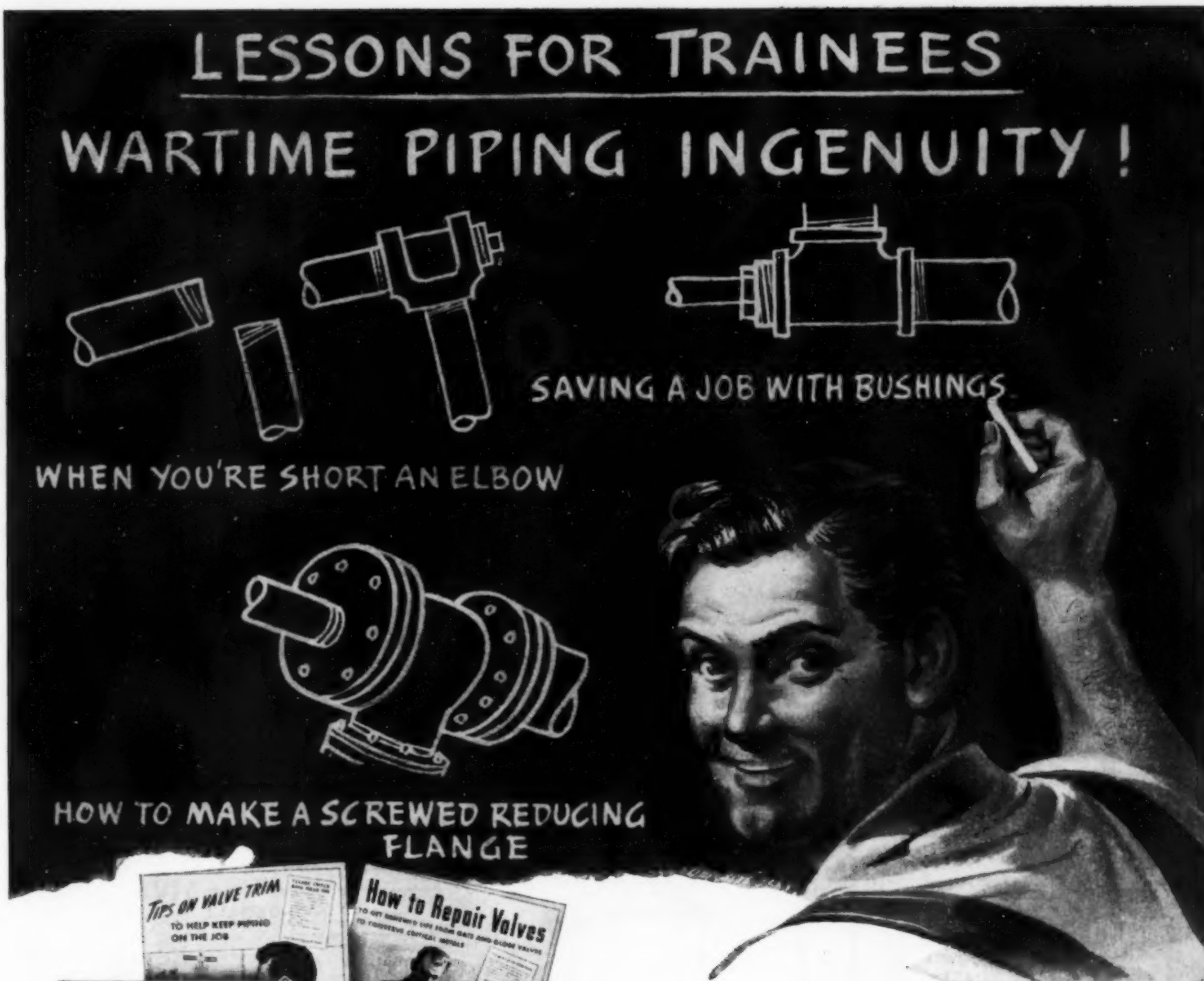

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"Piping Pointers" Give the Answers

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For your trainees, there's valuable help in Bulletin 6 of the "Piping Pointers" series—a Crane service aiding hundreds of plants in better wartime maintenance. Examples of the hints it gives—short cuts to faster piping jobs—practical suggestions on substitutions for critical materials—are shown above.

FREE ON REQUEST—**As the leading maker of valves and fittings, Crane Co. gladly shares the basic information on which "Piping Pointers" are founded, to help all industry get better service from piping equipment. Copies of Bulletin 6 and others supplied free by asking your Crane Representative, or by writing to: Crane Co., General Offices, 836 South Michigan Avenue, Chicago, Illinois.**

ARMY E NAVY

CRANE VALVES

Chemical Engineering NEWS

NEW MAGNESIUM PLANT IN OPERATION ON WEST COAST

The first of the units of the new government-owned magnesium plant at Spokane, Washington, went into operation on May 25. The plant is being built and operated by the Electro Metallurgical Co., a subsidiary of the Union Carbide and Carbon Corp., for the Defense Plant Corp.

Completed 11 months from the time construction work was started, the new plant is the first and largest completely integrated mill for the production of magnesium from dolomite by a thermal reduction method. Capacity of the plant, when in full operation by the end of this year, will be approximately four times the entire annual pre-war production of the entire United States.

The metallic magnesium to be produced in the Spokane plant will draw on raw materials found in the region. The method for the production, and the furnaces and equipment were designed by the Electro Metallurgical Co. In this process, calcined dolomite is smelted with ferrosilicon in large electric furnaces. Dolomite is abundant in the Spokane region, while the large amount of electric power required is obtained from the Grand Coulee Dam hydro-electric development.

ABBOTT LABORATORIES MAKES FELLOWSHIP GRANTS

Abbott Laboratories has announced that its plan of post-graduate fellowships for research in organic chemistry and in biochemistry will be continued for the academic year 1943-44. These fellowships are to aid capable graduate students in continuing their studies. There are no restrictions as to the professor under whom the work is to be done or the subject to be undertaken. The stipend is $750 per year. For the coming year the fellowships are available to both men and women.

The universities to whom these fellowships have been awarded for the coming year are, in organic chemistry, California, Illinois, Michigan, Minnesota, Purdue, Rochester, and Stanford; in biochemistry, Duke and Iowa State College.

COLLYER DISCUSSES POSTWAR POSITION OF RUBBER

Addressing the New York State Chamber of Commerce on June 3, John L. Collyer, president of the B. F. Goodrich Co., recommended that the nation's synthetic rubber facilities be kept intact after the war and in operation at least on a limited basis. He said world consumption of rubber, crude and synthetic might reach a total of 2,000,000 tons a year after the war, or almost twice as much as ever consumed even in the biggest years up to now. He said the progress already made in synthetic production had run ahead of expectations both as to indicated capacities of given plants and in the adaption of the material to necessary uses. A clue to the progress being made, as reflected in price, he said, was seen in the fact that while his estimate three years ago before a Senate committee that synthetic rubber could be produced on a large scale in this country for as low as 25c a lb. had been received with skepticism the office of Rubber Director Jeffers was reported as mentioning 16c as a probable price but it will take a lower cost than that to eliminate natural rubber on economic grounds.

SOLID MOLASSES PLANNED TO AID IN TRANSPORT

Molasses can be dehydrated and packaged in paper bags so that it may be moved in ordinary ship space from Cuba and Puerto Rico to the United States. This development, credited to the scientists and engineers of Board of Economic Warfare, may aid greatly in getting this important raw material to industrial alcohol plants of the Eastern Seaboard. Between 350 and 400 million gallons of molasses are available in nearby islands where facilities for evaporation to dryness are believed available in the present sugar mills, with very slight modifications and additions of equipment. Development work is in process under the public service patents which have been applied for. Any interested sugar producers or alcohol makers will be assisted in development work if desired. No estimates of cost are made by officials.

CHEMICAL SUBSTITUTES URGED FOR SCARCE ITEMS

WPB is aggressively working on alternate chemical supplies where otherwise increased production capacity would be necessary to meet essential industry needs. Great encouragement is being given, for example, to the development of apple honey, a sirup made from apple juice, as a substitute for glycerine in tobacco products. But at the same time other government officials warn that miscellaneous substitutions are to be watched carefully, especially in foods and drugs. Use of various glycols instead of glycerine in such commodities is particularly condemned.

The antifreeze problem also is causing active planning because butyl alcohol will not be available as a denaturant for much of the alcohol assigned to this service for next winter. About half of the 42.5 million gallons of alcohol so used will have to be denatured with other chemicals. Incidentally, methyl isobutyl ketone has to be allocated by WPB because of these scarcities.

GOLDENROD PLANTED AS PART OF RUBBER PROGRAM

Experimental plantings of four selected strains of goldenrod totaling 650 acres have been completed this spring by the USDA as part of the 1943 emergency rubber program. As authorized by Rubber Director William M. Jeffers, the Forest Service has planted selected strains of goldenrod on about 550 acres in the vicinity of Waynesboro, Georgia. Small experimental plots of two to ten acres were planted by the Bureau of Plant Industry, Soils, and Agricultural Engineering in South Carolina, Alabama, Mississippi, Louisiana, Texas, and California. Threefold purpose of the planting program is to determine the best locations, soil types, and methods for growing rubber-producing goldenrod; to obtain more complete information on possible yields; and to harvest a supply of goldenrod for testing extraction methods, and the properties and uses of the rubber product.

ARGENTINA AND CHILE ENTER INTO TRADE AGREEMENT

According to advices received by the Department of Commerce, Argentina and Chile have entered into a ten-year agreement whereby Argentina will purchase only natural sodium nitrate; will prohibit importations of substitutes; and will not construct a synthetic nitric acid plant. In return, Chile has agreed to maintain a supply of 10,000 tons of sodium nitrate in Argentina and to sell a maximum of 25 metric tons of iodine to the Argentine government for official industrial use. Provision is made for automatic renewal of the agreement after ten years.

FERTILIZER ASSOCIATION WILL MEET AT HOT SPRINGS

National Fertilizer Association will hold its annual convention June 21-23 at The Homestead, Hot Springs, Virginia. Government officials have been invited to participate so that the bulk of the program will be a war conference. Contrary to the usual custom the Association will not have an elaborate series of social functions nor the usual golf tournament.

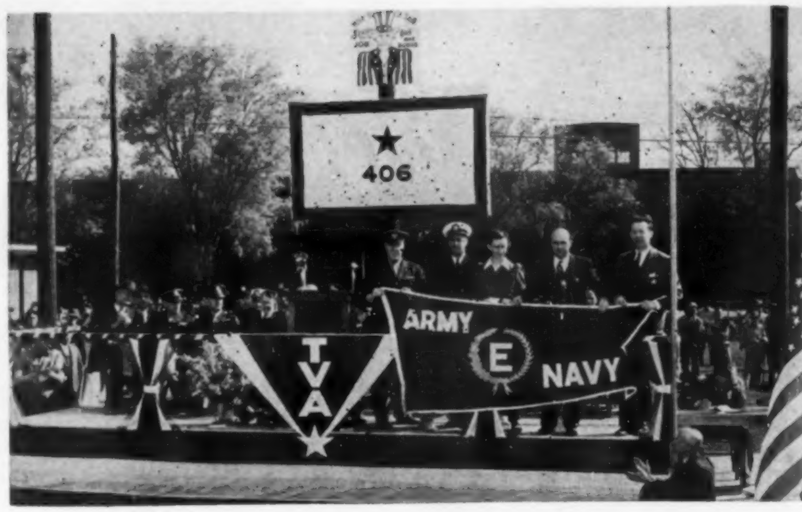
PLACEMENT OF CHEMICAL ENGINEERS

Chemical engineers and men and women with technical training are assured of all-round placement service when they register with local U. S. Employment Service offices, according to a statement of Paul V. McNutt, chairman of the War Manpower Commission. A cooperative procedure between the National Roster of Scientific and Specialized Personnel, of the WMC Bureau of Placement and all local offices of the Employment Service, has been placed in operation. The names of registrants, together with information regarding each applicant's availability, are now immediately sent to the National Roster if they cannot be placed locally.

ADVISORY COMMITTEE SET UP TO AID WAR INDUSTRIES

Early in 1942 a number of scientists in Minnesota felt they could make a greater contribution to the war effort if they were able to help solve scientific and technical problems that industries uncovered as they converted to war production. Discussions with government officials brought the suggestion from Dr. Donald Keyes that state organizations be established to handle in an advisory capacity the technical problems arising from the transition of industry to war work. As a result, Governor Stassen in cooperation with the Minnesota Resources Commission, set up a scientific advisory committee to Minnesota war industries. L. H. Reyerson, Professor of Chemistry and Director of the Northwest Research Institute, University of Minnesota was made chairman of the committee. Other members are T. L. Joseph, Professor of Metallurgy and Head of the Department of Metallurgy; I. M. Kolthoff, Professor of Analytical Chemistry and Chief of the Division; Louallen F. Miller, Professor of Physics; Ralph E. Montonna Professor of Chemical Engineering and Associate Director, Northwest Research Institute; Frank B. Rowley, Professor of Mechanical Engineering and Director of the Engineering Experiment Station; and M. B. Visscher, Professor of Physiology.

An advisory committee on chemical matters likewise has been appointed for the Detroit area of Michigan by Dr. Harvey N. Davis, Director of the Office of Production, Research and Development of WPB. Dr. Alfred H. White, Professor of Chemical Engineering, University of Michigan, is chairman of the committee and other members are: Dr. George Calingaert, Director of Chemical Research, Ethyl Corp.; Dr. Arthur H. Carr, Dean of the College of Engineering of Wayne University; Dr. Clyde C. DeWitt, Chairman of the Department of Chemical Engineering, Michigan State College; Ralph D. Hummel, Assistant Manager, Chemical Department, Parke, Davis and Co.; Dr. Harvey Merker, Superintendent of Manufacturing, Parke, Davis and Co.; Mark E. Putnam, Vice-President, Director, and Production Manager, Dow Chemical Co.; and Major W. P. Putnam, President, Detroit Testing Laboratory.



Employees of the Tennessee Valley Authority's Nitrate Plant No. 2 have received the Army-Navy "E" award for, according to Under Secretary of War Robert P. Patterson, "high achievement in the production of war material and for accomplishing more than seemed reasonable or possible a year ago." Colonel J. P. Harris of the Picatinny Arsenal presented the award and Arthur M. Miller, director of the Department of Chemical Engineering of the TVA, accepted it on behalf of the employees

E Awards

FOR PRODUCTION EXCELLENCE

Among the companies which, in the past month, have been awarded the honorary Navy "E" and joint Army and Navy "E" burgee for exceeding all production expectations in view of the facilities at their command, are included the chemical and explosives plants, the chemical process industries and the chemical engineering equipment concerns listed below. Other process and equipment plants will be mentioned in these columns as the awards are presented to the individual plants.

Alloy Steel Products Co., Linden, N. J.
American Art Metals Co., Inc., Atlanta, Ga.
American Brass Co., Kenosha Brass Co., Kenosha, Wis.
American Cyanamid & Chemical Corp., Selden Division, Bridgeville, Pa.
American Locomotive Co., Latrobe, Pa.
Badger Meter Mfg. Co., Milwaukee.
Bard-Barker Co., Danbury, Conn.
Bermite Powder Co., Saugus, Calif.
Borg-Warner Corp., Rockford Drilling Machine Division, Plants No. 1, 2, and 3, Rockford, Ill.
Brass Foundry Co., Peoria, Ill.
Bridgeport Brass Co., Ordnance Plant, Indianapolis.
Brown Steel Tank Co., Minneapolis.
Buffalo Arms Corp., Buffalo.
Chicago Bridge and Iron Co., Ship Building Division, Seneca, Ill.
Cleveland Tractor Co., Cleveland.
Arthur A. Crafts Co., Boston.
Cudahy Packing Co., Omaha, Nebr.
Curtiss-Wright Corp., Propeller Division, Beaver, Pa.
Defiance Automatic Screw Co., Defiance, Ohio.
DeLong Hook and Eye Co., Philadelphia.
E. I. du Pont de Nemours & Co., Electrochemical Division, Perth Amboy, N. J. and Belin Plant, Moosic, Pa.
Erie Foundry Co., Erie, Pa.
Evansville Ordnance Plant, Chrysler and Sunbeam Divisions, Evansville, Ind.
Federal Cartridge Corp., Twin City Ordnance Plant, Minneapolis.
General Motors Corp., Fisher Body Division, Aircraft Unit, Plant No. 21 and Fleetwood Unit, and Research Laboratories, Detroit.
B. F. Goodrich Co., Clarksville, Tenn.
Gustin-Bacon Mfg. Co., Insulation Board Plant, Kansas City, Kans., and Rolagrip Pipe Coupling Division, Kansas City, Mo.
Hardie-Tynes Mfg. Co., Birmingham, Ala.
Improved Paper Machinery Corp., Nashua, N. H.
International Industries, Inc., Plant No. 2, Ann Arbor, Mich.
Jones & Laughlin Steel Corp., Pittsburgh.
Lawrence Leather Co., Shearling Tannery, Winchester, N. H.
Link-Belt Co., Ewart Works, Indianapolis.
Link-Belt Ordnance Co., Chicago.
Mall Tool Co., Chicago.
Mason Can Co., East Providence, R. I.
Maxim Silencer Co., Hartford, Conn.
Metal Specialty Co., Cincinnati.
Minneapolis-Moline Power Implement Co., Como Ordnance Plant, Minneapolis.
Nashawena Mills, New Bedford, Mass.
National Enamel & Stamping Co., Granite City, Ill.
D. W. Onan & Sons, Arrowhead, Madison, Royalston, and University Plants, all in Minneapolis.
Parkersburg Rig and Reel Co., O. C. S. Division, Coffeyville, Kan.
The Protectoseal Co., Chicago.
Philadelphia Gear Works, Inc., Philadelphia.
Quaker Oats Co., Cedar Rapids, Ia.
R. C. A. Laboratories, Princeton, N. J.
Resinous Products and Chemical Co., Bridesburg, Philadelphia.
Revere Copper & Brass, Inc., Baltimore.
John Royle & Sons, Paterson, N. J.
Skilsaw, Inc., Chicago.
Savannah Machine & Foundry Co., Savannah.
E. H. Scott Laboratories, Inc., Chicago.
J. P. Seeburg Corp., Plants No. 1, 2, and 3, Chicago.
Stamford Rolling Mills, Springdale, Conn.
St. Charles Mfg. Co., St. Charles, Ill.
Thomson Machine Co., Belleville, N. J.
Thomson Co., Thomson, Ga.
Tappan Stove Co., Mansfield, Ohio.
United States Metals Refining Co., Carteret, N. J.
United States Rubber Co., Shelbyville, Tenn., and Eau Claire Ordnance Works, Eau Claire, Wis.
Vaughan Novelty Mfg. Co., Inc., Chicago.
Wald Mfg. Co., Inc., Maysville, Ky.
F. W. Wakefield Brass Co., Vermilion, Ohio.
Wayne Pump Co., Fort Wayne, Ind.
Wilson & Co., Inc., Chicago.
Worcester Moulded Plastics Co., Worcester, Mass.

WASHINGTON NEWS

Rows between government agencies are to be settled by an old arbiter with a new title, James F. Byrnes, now Director of War Mobilization. Moving rapidly to beat Congress to the Punch, President Roosevelt established his super agency Office of War Mobilization. Next to the President, Byrnes becomes the most powerful figure in Washington. He is on a par with the chiefs of staff and can also issue directives to them. Donald Nelson, WPB Chairman, is in third place and many think that he has abdicated that spot in favor of Charles Wilson, WPB Executive Vice Chairman, who has been both calling the signals and carrying the ball in recent months.

Congressional action to form an Office of War Mobilization was started last session, the idea being an overall top agency similar to the one established by the Executive Order of May 27, 1943. At the request of the Administration the idea was allowed to languish in committee. In the meantime, Donald Nelson moved to forestall Congress by requesting the President to appoint three new members to the War Production Board (*Chem. & Met.*, May, 1943, p. 165). The enlarged War Production Board provided a common meeting ground for all government agencies engaged in the production of raw materials and their fabrication for war and for essential civilian supply. Subsequent events have shown that Mr. Nelson was unsuccessful in his effort to prevent another layer of Bureaucracy from being interposed between his office and the White House.

The only comparable grant of presidential power to that given Justice Byrnes occurred in January, 1942, when the War Production Board was established under the direction of Donald Nelson. Some powers granted to the WPB Chairman were never exercised and others were delegated to the various "Czars." The latest Presidential action again places power over production and procurement in the hands of one man.

President Roosevelt stated at the time OWM was created, "We are entering a phase of the war effort when we must streamline our activities, avoid duplication and overlapping, eliminate interdepartmental friction, make decisions with dispatch, and keep both our military machine and our essential civilian economy running in team and at high speed."

The executive order establishing the Office of War Mobilization also established a War Mobilization Committee consisting of the Director, Secretary of War, Secretary of Navy, chairman of the Munitions Assignment Board, chairman of the War Production Board, and the Director of Economic Stabilization. Power to act is vested in the Director of War Mobilization. Paragraph III of the Executive Order, giving the functions of the office, reads, "It shall be the function of the Office of War Mobilization, acting in consultation with the committee and subject to the direction and control of the President.

"(a) To develop unified programs and to establish policies for the maximum use of the Nation's natural and industrial resources for military and civilian needs, for the effective use of the national manpower not in the armed forces, for the maintenance and stabilization of the civilian economy, and for the adjustment of such economy to war needs and conditions.

"(b) To unify the activities of Federal agencies and departments engaged in or concerned with production, procurement, distribution or transportation of military or civilian supplies, materials, and products and to resolve and determine controversies between such agencies or departments, except those to be resolved by the director of economic stabilization under Section 3, Title IV, of Executive Order 950; and

"(c) To issue such directives on policy or operations to the Federal agencies and departments as may be necessary to carry out the programs developed, the policies established, and the decisions made under this order. It shall be the duty of all such agencies and departments to execute these directives and to make to the Office of War Mobilization such progress reports as may be required."

No action has been taken up to the first week in June to indicate how Director Byrnes intended to operate in his new office. In Washington, it was believed that the actual change in functions would be slight, since settlement of inter-agency disputes had been engaging more and more of Mr. Byrnes' time.

Immediately following the new assignment for Mr. Byrnes, there was much speculation as to whether the President's latest move would forestall the desire of Congress to set up a new civilian supply agency. It was felt that in the event that Congress went ahead with its ideas it would cause the Administration no embarrassment. OWM is a tent that covers the main acts and the side shows as well. An autonomous civilian supply agency would fit in with the rest, directly under control of Mr. Byrnes.

Director of Economic Stabilization, Fred M. Vinson, continues to resolve differences of opinion between OPA and the War Labor Board and OPA and the War Food Administration having to do with the Price Control Act and ceilings on agricultural commodities.

War Production Peak

Peak of war production is to be reached in the fourth quarter of this year. The general production curve will continue to rise until some time in the fall when it is expected to level off for the duration. From now on one of the major problems will be to expand production of raw materials to meet the additional requirements of the mills and factories making military items.

Top ranking WPB officials are worried over the public reaction to cut-backs in tank and munition programs and to such announcements as that machine tool production is due to be curtailed. It is feared a general feeling that "we are over the hump" will have an adverse effect on the quantity of goods turned out.

In the case of the machine tool industry, the further announcement that the facilities released would be converted to production of military equipment of some kind has not been appreciated. Proof of fuzzy thinking has been the reclassification of tool makers to A-1 draft status by some draft boards. Induction of hundreds of these highly skilled artisans into the armed services has resulted in the face of industry's crying need for skilled mechanics to help put over the last big production drive that faces the nation. The induction of tool makers is second only to the situation in some localities where miners have been urged to go on to farms or face induction in spite of shortages of metals and minerals that now exist.

This is a partial explanation of the concern with which WPB Chairman Donald Nelson and his immediate advisors view the current situation. They have spent much time recently explaining that greater quantities of raw materials are going to be needed in spite of the cut-backs in certain programs. While some programs are being curtailed others will continue to expand. Tank production reached its peak last December and since then has been trimmed to meet actual day-to-day military requirements. Bombers will be built in increasing numbers until the peak is reached some time in 1944. Other adjustments in production schedules are being made to correct the errors in judgment made last year.

Except in emergencies now unforeseen there will be little future construction of new plant facilities. The building program is rapidly coming to a close but plants already scheduled for manufacturing high octane gasoline, synthetic rubber and new types of explosives will be under construction for some months to come—possibly well into 1944. Materials that have been going into factory buildings will be diverted into production channels from which they will emerge as ships, tanks, guns, planes, etc.

Washington officials know that the supply of materials and critical common components will scarcely meet actual requirements until sometime after the production peak has been reached. To

insure the proper distribution of the scanty supplies there is to be further scheduling not only of raw materials but also of critical components and facilities.

Control of Materials

With CMP just about through its trial run and scheduled to become mandatory July 1, WPB has come up with two new devices, both of which represent further steps in the evolution of materials control. The more formal of these is the Component Scheduling Plan, which will see to it that the supply of critical common components is geared precisely to the supply of scheduled end products. Considerably less formal, and currently less complete, is a preference rating system for facilities.

The Component Scheduling Plan exists in fact, although as yet it has no directive in the sense that the Controlled Materials Plan has. Orders placed after June 1 for the components affected by the plan must go through the WPB industry divisions which handle such components. It will be the duty of these industry divisions to see that the component production schedules end products. A favorite explanation of CMP was based on the futility of allocating steel for fifty tanks unless rubber and steel for 100 tracks also was allocated. Applying this reasoning to CSP, it becomes immediately obvious that production of 50 internal combustion engines, which are controlled components, is merely a waste of time unless, at the proper point in their production, the manufacturer gets 50 crankshafts, which are sub-components.

The facilities preference rating scheme has hardly taken recognizeable shape thus far, publicly at least. It has been announced merely that a system of preference ratings for use of facilities has been authorized, and that "appropriate administrative orders and directives" will be issued. For the present at least, these "equipment priorities" will be confined to contracts calling for fabrication or processing rather than for delivery to an ultimate consumer, to contracts calling for use of equipment in essential construction not involving delivery of materials, and to contracts for use of facilities for repair and maintenance of plant or equipment of essential producers.

Manpower Regulations

Running true to form the War Manpower Commission has established the machinery by which the 48-hour week order and the employment stabilization plan can be completely emasculated. WMC Regulation No. 5 establishes the method by which appeals from any of the manpower regulations may be made by both employees and employers.

The new regulation prescribes who may appeal, actions from which workers may appeal, actions from which employers may appeal, notification of the right to appeal and officers and committees to whom appeals are originally taken. After decisions on the original appeals, further appeals to the Regional Management-Labor Manpower Committees and to the Chairman are possible.

The regulation provides that appeal of an employer from a decision granting one of his workers a statement of availability in no way stays the effect of the decision so far as the worker is concerned, but the officer to whom the appeal is taken may direct that subsequent cases involving other workers of an employer and raising identical issues may be suspended pending final settlement of the issue. There is a similar provision protecting employers who are satisfied with certain decisions from which workers may appeal. In all other cases the taking of an appeal stays the action appealed from, unless the chairman of the Committee to whom the appeal is taken specifically directs otherwise.

Inventory Restrictions

Inventory restrictions imposed by CMP Regulation No. 2 are not as drastic as has been interpreted by some members of the chemical industry. No company should take a chance of halting production by failure to keep on hand repairs to meet unpredictable demands. The official interpretation on this very point in "Questions and Answers Regarding Operation Under the Controlled Materials Plan" explains that it is possible to maintain an adequate inventory and remain within the intent and meaning of Regulation No. 2. The official answer reads:

"With regard to material needed for uses which are authorized but which are not specifically predictable, CMP Regulation No. 2 permits a company to have on hand at any time the amount of each item which it estimates it must have in order to meet the demands which it reasonably anticipates arising during the next 60 days. In computing the amount which it is considered necessary to have on hand, the estimates should be based on past experience of use, the possibility of obtaining material from warehouses, and upon the length of time required to obtain delivery from producers under CMP. Acceptance of delivery of controlled materials must be in such quantities that the limitations described above will not be exceeded.

"This standard need only be applied when the amount which the company wishes to receive is greater than the allowable minimum shown on Schedule A of the Regulation."

Just as the inventory restrictions have caused some producers trouble the question whether pipes, tubes, channels, rails, and similar mill products are fabricated items is causing trouble for other producers. These shapes fall into the group listed in Schedule 1 of CMP Regulation No. 1 which are classed as controlled materials.

Producers who have received a general authorization under P-89 do not have to write to Washington for specific permission to apply ratings and allotment symbols to their purchase orders for mill items classed as controlled materials. The only restriction is that the total purchased in the allotment period must not exceed the authorized quota.

There also seems to be some confusion among producers on the procedure to follow to secure fabricated repair items costing more than $500. Producers operating under P-89 must file a specific application as outlined in Paragraph E of the order for permission to apply their rating and allotment symbol to the purchase orders for any fabricated item costing more than $500 per unit.

In cases where the manufacturer is operating under CMP Regulation No. 5, fabricated items costing more than $500 may not be purchased. An official interpretation issued last March was still good for the amendment of Regulation No. 5 which came out May 14. The question and answer read as follows:

"CMP Regulation No. 5 states that 'repair' means the restoration of a facility to sound working condition when it has been rendered unsafe or unfit for service by wear and tear, damage, failure of parts or the like. May I obtain a new boiler costing $2,000 under the procedures provided in the regulation to replace a boiler which has been damaged beyond repair?

"Answer—No. A boiler which is damaged beyond repair and which costs in excess of $500 to replace cannot be obtained under the provisions of this regulation. However, your attention is called to paragraph (b) (3) of the regulation which permits minor items of productive capital equipment, minor capital additions or replacements not exceeding $500 to be included as maintenance, repair and operating supplies."

The Corn Supply

There will be no corn for whiskey, industrial alcohol, or corn products' manufacturers until the new crop is harvested. The tight situation was emphasized in mid-May when zein, the alcohol soluble protein derived from corn was placed under allocation control. While there is a vast quantity of corn in the country, the supplies are on the farms and will stay there until there is a drastic change in government policy.

The situation might be explained by saying that a government priority for hogs has been established. It is a priority of position since both corn and hogs are on the farms. The corn-hog ratio aided by the ceiling on cash corn, has made it more profitable for the farmer to feed his corn than to sell it.

The wet millers had their product frozen at the March, 1942, price level by the General Maximum Price Regulation. At that time the price of corn was about 80 or 82 cents per bushel. They cannot buy corn at the present ceiling and break even let alone make a profit.

Top government officials have been reluctant to meet the problem head on. To date action has been slow. Release of some CCC corn and application of inventory regulations has helped soften hog prices. Rationing of pork products to consumers may further weaken hog prices which will help to change the direction of flow of surplus corn from the feed lot to industry.

READERS' VIEWS AND COMMENTS

COTTON AS FOOD

To the Editor of Chem. & Met.

Sir:—My attention has been called to an erroneous statement in an editorial entitled "Cotton As a Food," Chemical and Metallurgical Engineering, April, 1943, page 96. It is claimed that "An acre of cotton provides more edible oil and edible protein than an acre of any of the competitive crops such as soybeans and peanuts." This is a gross misstatement. Accepted average figures for the United States are given in Fats and Oils Situation, FOS-73, March 1943, as follows:

Yields per acre	Cottonseed	Peanuts	Soybeans
Oil, lb.	72	216	169
Meal, lb.	206	323	912
Protein (41%), lb.	85	132	374
Oil and Protein, lb.	157	348	543

The editorial bases its figures on the incorrect assumption of a bale-per-acre yield. Average yields are more nearly one-half bale per acre. Moreover, the editorial claims that approximately 400 lb. of edible protein are obtained with every bale of cotton. Actually, the yield per bale of lint cotton is approximately 400 lb. of meal which is only 41 per cent protein. Thus, the oil figure in question is approximately twice as high as it should be and the protein yield given is almost five times the actual.

C. T. LANGFORD

EDITOR'S NOTE—It is quite evident that we tried to do too much in a short space and consequently gave an erroneous impression in the two particulars which Dr. Langford noted. Perhaps the most serious distortion comes from the fact that the protein meal from cottonseed was referred to as though it were all protein.

It is not surprising that Dr. Langford should take exception to the phrasing in the first sentence of our second paragraph. Therein should have been pointed out that "an acre of cotton *can* provide, *according to enthusiastic partisans*, more edible oil and edible protein meal. . . ." That would have been true. To be fair one would have to assume also one bale of cotton per acre.

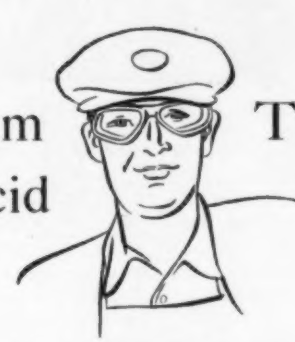
Department of Agriculture figures indicate that the ratio of lint production to cotton seed production is 35 lb. to 65 lb. for typical conditions in the United States. On such a ratio, assuming a bale per acre, one gets very much higher oil and meal totals than are represented by the averages quoted by Dr. Langford.

There is a discrepancy in oil figures which we have received and those quoted by Dr. Langford. Probably his figures relate only to the actual oil production in practice during the 30's divided by the total acreage planted or harvested. It seems as though the total oil in the seed produced per acre is much higher than he indicates. The figures which we have are nearly double his.

It may be assumed that the cotton advocates are not unduly distorting their arguments if they are discussing an increase in cotton acreage for some of the better areas where there is neither the machinery nor experience for greater production of soybeans and peanuts. Actually we know that a very large percentage of last year's crop of these two important crops was never harvested. We may expect a similar unfortunate result this year, despite strenuous efforts of the Department. For this reason we are a little disposed to let the cotton extremists have a bit of superlative in their claims. It does seem that the effective production per acre contributing to food supplies that can be delivered to market will be greater under these conditions, governing for many hundreds of thousands of acres. Such a condition will not persist for many years after experience and machinery corrects present difficulties. But, as a wartime measure, we are inclined to think that the point which we were willing to let these cotton boosters make editorially is a sound one.

It seems that the most important consideration for chemical engineers, and one which made us interested in this editorial idea, is that we must improve materially the technique of processing these oil seed crops in order to increase yields of food-quality products.

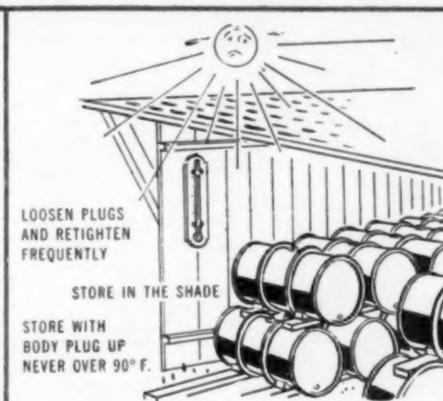
This is a drum containing acid



This is a new hand in your plant

...and here are 6 ways to keep both working for victory!

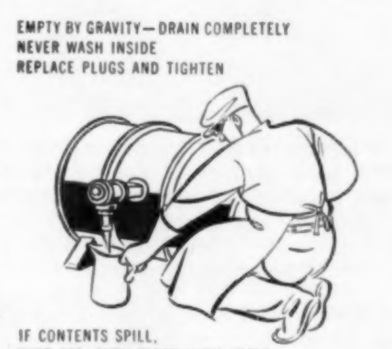
As soon as drum is received, check for leaks as corrosion-resistant lining may crack during shipment . . . Protective clothing also prevents accidents.



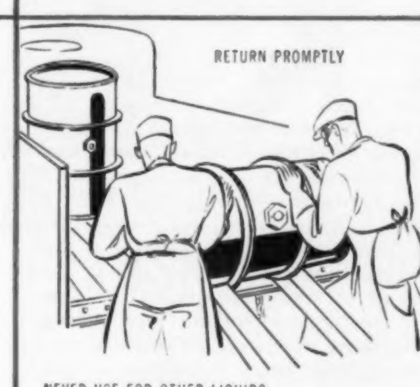
Remember—even water expands into steam under sufficient heat. Most chemicals require much less heat to build up dangerous internal pressures.

Hydrogen mixtures may build up inside a drum from the action of its contents on metal. A spark from a tool, a careless cigaret or match — and you have an explosion!

You never know until too late whether internal pressure will force a drum's contents out in a rush the minute you loosen the plug. *Always* play safe!



In emptying, never use pressure. After emptying, drain completely and replace plugs securely to prevent corrosion on the return trip. Never wash the inside of a drum!



Steel containers are literally worth their weight these days in ammunition. From the time they reach your plant, handle them carefully. Return them promptly.

To old hands at handling chemicals these precautions will be primer stuff — but old hands are becoming scarce in many a plant which uses substantial quantities of potentially dangerous chemicals. These suggestions are offered, therefore, as a help in impressing new employes with the importance of protecting their own safety and also conserving vital shipping containers. The suggestions are based on one of a series of bulletins issued by the Manufacturing Chemists' Association.

For more detailed help on specific chemicals conservation problems in your plant or training new employes to handle chemicals safely, write: MONSANTO CHEMICAL COMPANY, St. Louis, Missouri.

MONSANTO CHEMICALS

SERVING INDUSTRY...WHICH SERVES MANKIND

"E" FOR EXCELLENCE—The Army-Navy "E" burgee with two stars, "representing recognition by the Army and the Navy of especially meritorious production of war materials" over a two-year period flies over Monsanto.

INTERPRETING WASHINGTON

EDITOR'S NOTE: *Copies of the orders, rules and regulations covered in this installment may be obtained by writing to the appropriate federal agency, citing the order number or release date.*

INDUSTRIAL INSTRUMENTS

Limitation Order L-272 was amended on May 29 to provide for simplification of indicating dial pressure gauges and various types of regulators.

The pressure gauges are covered by Schedule IV which regulates the sizes and ranges in which gauges may be manufactured. Special features are eliminated and a standard connection is designated for larger sizes.

Schedule V specifies sizes and pressure classes for steel, iron or bronze body regulators, also materials for inner valves and seat rings. Exceptions are allowed for the armed services.

L-272 applies only to new purchase orders. Where Schedule V conflicts with Order L-134, which curtails the use of chromium and nickel in industrial instruments, the less restrictive Order governs.

STEEL PIPE FITTINGS

Limitation Order L-278, issued May 8 by WPB, reduces the number of types of steel pipe fittings which may be made from 40,000 to less than 4,000. Iron and brass pipe fittings were previously simplified by Order L-288. Changes in specifications of materials and of pressure classes correspond closely with those of Order L-252 covering valves and valve parts. The chief reductions are in the number of sizes permitted for "reducing fittings," used to join pipes of different diameters.

Certain types are exempt such as those for use on airplanes and ships, conductors of corrosive liquids or gases, those specially designed for combat use, those used to replace special type fittings, and others which are enumerated in a list of special types. The types permitted comprise about 98 percent of all produced.

REFRIGERATION AND AIR CONDITIONING

General Limitation Order L-38 was amended on May 28 by WPB to bring it in line with the minimum preference ratings for repair and maintenance parts established by CMP Regulation No. 5 as amended May 14. Purchase orders for maintenance and repair parts for industrial and commercial refrigerating and air conditioning equipment must bear preference ratings of AA-5 or higher under the new amendment.

POWER AND CONVEYING EQUIPMENT

General Limitation Order L-193 as amended on May 10 by WPB, provides that purchase orders for conveying machinery and mechanical power transmission equipment are restricted to those rated AA-5 or higher under the terms of the Order. The definition of conveying machinery was clarified by naming portable conveyors, now covered by Limitation Order L-287, as one of the items exempted. Slope conveyors used in mining are also exempted. Monthly production and delivery schedules are no longer required since scheduling is now covered by General Scheduling Order M-293.

FORM PD-1A APPLICATIONS

In line with its policy of decentralization, the WPB has raised the dollar limit of PD-1A applications processed in the field from $100 to $500. Applications involving not more than $500 worth of material on which priority assistance is requested, are now processed in either the District or Regional offices according to the direction of the respective regional directors, except where specifically otherwise directed by the Director of the Distribution Bureau. This change means that approximately 80 percent of all PD-1A applications will be handled entirely by the field offices.

CALCIUM METAL

Conservation Order M-303 was amended on May 25 by WPB to permit industrial users who require small quantities to accept and use three pounds of calcium metal in the form of carrots, or two pounds of calcium metal in any other form per month without specific authority of the WPB.

TANTALUM, MOLYBDENUM, TUNGSTEN

Future requests for tantalum, molybdenum, and tungsten should be made in terms of kilograms instead of pounds avoirdupois, the Steel Division announced on May 25. The date for filing Forms PD-487 and PD-488 for allocation of tantalum has been changed from the 20th to the 7th of the month preceding the month for which application is made.

SOLUBLE NITROCELLULOSE

General Preference Order M-196 which governs the delivery and use of soluble nitrocellulose, was revoked by WPB on May 14. At present, supplies are adequate to meet the need for this material which is used for such products as lacquer, coated textiles, photographic film and plastics both for military and civilian items.

CHLORINATED SOLVENTS

General Preference Order M-41 was amended on May 20 by WPB to permit greater quantities of chlorinated hydrocarbon solvents for civilian uses. The Order provides that with a preference rating of B-2 a consumer may receive in any one month not more than his average monthly consumption during the base period of the year ending September 5, 1941. In the case of carbon tetrachloride, a consumer may receive delivery in any month of up to 150 percent of his average monthly consumption during the base period. These allotments for civilian uses may, of course, be obtained only after all military requirements have been fulfilled.

MICRO-CRYSTALLINE WAX

Allocation Order M-195 issued by WPB on May 19 and effective July 1 provides that no supplier of micro-crystalline wax and its blends may use or deliver wax except as specifically authorized by WPB. The usual allocation Forms PD-600 and PD-601 should be used by suppliers and consumers.

PAPER AND PAPER BOARD

General Conservation Order M-241 was amended on May 15 by WPB to clarify and define certain points and to provide a clear and equitable basis for the classification of paper products for the industry. Formerly, three unrelated codes were used, but under the amendment a standard classification code is now set up by the Bureau of the Census which is covered by WPB Form 514, dated February 24, 1943. The change to census code numbers will simplify the calculations of paper quotas in the mills and aid in carrying out the production limitation of paper by broad grade classifications. All limitations remain as previously outlined in the Order last amended on March 12, 1943.

ETHYL CELLULOSE

General Preference Order M-175 was amended on May 6 prohibiting the use of ethyl cellulose except on specific authorization by WPB. The general 50-lb. exemption for small purchase orders has been replaced with a 10-lb. exemption and in the case of acceptance or use for experimental purposes, an exemption of 50-lb. The amended Order also provides that ethyl cellulose allocated for inventory may not be used except as specifically authorized or directed in writing by WPB. The standard chemical allocation Forms PD-600 and PD-601 should be used by applicants for authorization to deliver, accept delivery or use ethyl cellulose.

SULFAMIC ACID

General Preference Order M-242 was amended by WPB on May 7 to provide for the use of Form PD-602 in place of the regular Forms PD-600 and PD-601, formerly used. Paper work is eliminated by providing that a producer or primary distributor need not list on Form PD-602 the name of any customer to whom not

Please note — this may be important! JW.

more than 2,500 lb. of sulfamic acid derivatives are to be delivered in any month for use as weed killer, or for resale for use as weed killer. A producer who wishes to use a part or all of his own production of sulfamic acid must list his own name as customer on the new forms.

ISOPROPYL ALCOHOL

General Preference Order M-168 was amended on May 18 by WPB to simplify the paper work required of a supplier seeking authorization to make deliveries of, or to use, isopropyl alcohol. Whereas previously Forms PD-600 and PD-601 were required, Form PD-602 may now be used. Requests for quantities up to 3,500 gallons in any one month must be lumped by the supplier on Form PD-602 under specified end uses, and requests for more than 3,500 gallons in any one month must be listed individually.

SYNTHETIC RUBBER INGREDIENTS

WPB on May 8 specified the use of Form PD-602 in place of the two Forms PD-600 and 601 when applying for authorization to use or deliver three basic materials used in manufacturing synthetic rubber. The following three Allocation Orders were amended to cover the use of this new form:

M-170, styrene (vinyl benzene).
M-153, acrylonitrile (vinyl cyanide).
M-178, butadiene.

ROTENONE INSECTICIDE

WPB Directive No. 15, issued on May 8, transfers to the War Food Administrator control over the uses and distribution of rotenone insecticide for agricultural purposes. The amended directive reserves to the WPB the right to determine the amount of government requirements for rotenone and rotenone insecticide, to regulate or prohibit the manufacture or importation of rotenone and to regulate or prohibit the use or sale of rotenone insecticide for non-agricultural purposes.

WOOD PULP

The "withholding clause" of General Preference Order M-93 was invoked on May 4 by WPB through issuance of Supplementary General Preference Order M-93-a. All producers of wood pulp must withhold 20 percent of their production of all types of wood pulp during the month of June and each month thereafter, and must make delivery of such withheld tonnage only as ordered by WPB. While the wood pulp shortage has reached the point where it is deemed necessary to invoke the withholding clause of the Order, the power to allocate such tonnage will be used only to safeguard important war production, and it is very likely that, in many cases, all or most of the withheld wood pulp will be allocated back to the producer.

DYESTUFFS

Order M-103 was amended on May 25 permitting commercial dyers to get all the dyestuffs and organic pigments which are required for dyeing used apparel and used house furnishings without adher-

ing to quota restrictions. The amended Order also contains an exemption for food, drug and cosmetic colors. Another exemption permits unrestricted sales and deliveries of any dyestuffs and organic pigments to any person for medicinal, therapeutic and diagnostic uses and for chemical indicators and bacteriological stains. These unrestricted sales and deliveries must be in packages of eight ounces or less.

LEAD

General Preference Order M-38, which controls the use of lead, was amended on May 26 to facilitate the use of lead in place of scarce materials. As it stands now, the Order places practically no restrictions on the use of lead except for purposes considered purely non-essential. Restrictions on roofing and weight of flashing and waterproofing are removed. The former restriction on the use of lead for many purposes to a quantity not exceeding 90 percent of the amount used in a base period has been removed, making it possible to use lead without special approval for items not previously made of lead.

ALKANOLAMINES

Allocation Order M-275 was amended on May 25 by WPB placing diethylethanolamine under allocation and removing triethanolamine. Alkanolamines are now defined as "monoethanolamine, diethanolamine and diethylethalomine." Orders for five gal. or less of diethylethalomine per month will be permitted without WPB authorization after July 11.

PHOSPHATE PLASTICIZERS

Allocation Order M-183 was amended on May 24 to include control over diphenyl mono-phosphate and di-monophenyl phosphate. Allocations may be requested by filing standard Forms PD-600 and PD-601 with the Chemicals Division of WPB.

BUTYL ALCOHOL

General Preference Order M-159 which controls all grades of butyl alcohol was amended on May 26 to include control over the acetic esters of butyl alcohol. These are the normal butyl acetate, secondary butyl acetate and isobutyl acetate. The usual Forms PD-600 and PD-601 must be used to obtain an allocation, a separate set of forms being used for each grade of butyl alcohol requested.

METHYL ISOBUTYL KETONE

General Preference Order M-322 issued on May 25 by WPB placed hexone, or methyl isobutyl ketone, under allocation. Its chief uses are as an alcohol denaturant and a substitute for butyl alcohol. Up to fifty gallons per month may be obtained without specific authorization. For larger quantities the purchaser must file with his supplier a statement of the amount desired together with the proposed end uses. The supplier must then file Form PD-602 covering his proposed deliveries.

THERMOPLASTICS

General Preference Order M-154 was amended on May 25 removing the prohibition covering the use of thermoplastics in the manufacture of "sun goggles, except for use with corrective lenses". Control will be exerted by amendment to Limitation Order L-238, covering sun glasses.

FIBRE SHIPPING DRUMS

Conservation Order M-313 issued by WPB on May 21 provides for the allocation of shipments of cylindrical fibre shipping drums by manufacturers, as of June 16. The Order applies to the types known as "drums" and "pails". They are made with a body of paperboard and ends of paperboard, steel (28 gauge or heavier), wood, or any combination of such materials. Drums or pails of one-gallon capacity, and fibre containers known as "cans" and "tubes", are excluded from the Order.

Notwithstanding any preference rating already received, no manufacturer may ship fibre drums after June 16 to any purchaser except as specifically authorized by WPB on Form PD-881. Suppliers must file this form monthly, listing each customer's proposed use and desired delivery date for drums. No person may order any type of fibre drum for delivery on any date if receipt of the drums would increase his estimated inventory of that type drum to more than 60 day's requirements.

MAXIMUM PRICE REGULATIONS

MPR-37, Amendment No. 4, issued by OPA on May 7, revised the ceiling prices for fermentation butyl alcohol. Wheat constitutes the chief butyl alcohol source in states other than the Indiana-Illinois area and is at the present time being supplied at a uniform delivered price, but on July 1 this price will be raised to nine cents under the maximum price for corn. This amendment, accordingly, provides for increased prices for butyl alcohol produced outside Indiana and Illinois. The existing base ceiling will be maintained in Indiana and Illinois.

MPR-180, issued May 8 by OPA, placed under one specific price regulation all dry, flushed and pulp color pigments. The price levels which have been set reflect price ceilings as of October, 1941. For the purpose of the regulation, organic and inorganic color pigments have been grouped together. Type listings have been divided into shades; blues and violets, greens, yellows and oranges, reds and maroons. White, mineral earth, synthetic iron oxide and carbonaceous black pigments will remain under the control of the General Maximum Price Regulation. Formulas are provided for pricing new color pigments, or color pigments not specifically listed in the Regulation.

MPR-386 (agricultural mining materials), effective May 15, establishes a variety of optional methods for determining f.o.b. plant prices for liming materials in bulk when used as an aid to the growth of crops in plants. When

liming materials are sold in bags, 25 cents per ton, plus the cost of the bag, may be added to the bulk price.

MPR No. 354, amended on May 11 by OPA, permits distributors who make retail sales of copper sulphate as an agricultural insecticide or fungicide to use the maximum prices provided for retail dealers in MPR No. 144. For quantities of 300 lb. or more, however, the distributor must use the wholesale ceilings established by Regulation No. 354.

REVISED PRICE SCHEDULES

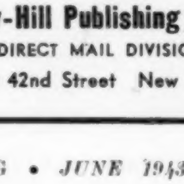
RPS-38 was amended by OPA on May 11 to conform more exactly to conditions as they actually are in the glycerine industry, and was redesignated Maximum Price Regulation No. 38. A converter is defined as a person who buys refined glycerine in quantities of 2,200 lb. or more per month in drums or tank cars and who repackages it without further processing for resale. Other definitions such as "carloads," "case," "importer," are also clarified in this amendment. The maximum prices established in the previous schedule are not changed by this amendment.

RPS-60, Amendment No. 7, issued by OPA on May 7, extended the same pricing provisions in connection with purchases, sales and transportation of direct-consumption sugar which previously covered the Defense Supplies Corp. The amendment also provides that any other government agency which may, in the future, be authorized to perform such functions shall be in the same category.

RPS-87, Amendment No. 5, issued by OPA on May 6, states that the maximum price for hard rubber scrap shall be determined in accordance with the provisions of the General Maximum Price Regulation and not under RPS-87. Under Schedule 87 hard rubber scrap would be entitled to a maximum price of $15 per ton, whereas prices of such scrap ordinarily range, in accordance with its grade, from $5 to several hundred dollars per ton.

RPS-88, Amendment No. 95, issued May 7 by OPA, removes from the General Maximum Price Regulation and places under Schedule 88 industrial napthas, solvents, mineral oil polymers, and petroleum sulphonates. However, sellers still have the option of retaining maximum prices already established under the General Maximum Price Regulation, or using an alternative method in Schedule No. 88.

Revised Supplementary Regulation No. 1 to GMPR was amended on May 31 to exempt from price control those commodities which are insignificant in the cost-of-living, or which impose administrative burdens out of proportion to the role of the item in the national economy. Specifically exempted are manufacturers' sales of chemicals, which they did not sell up to March, 1942, until total sales for the chemical amount to $1,000. Sales of chemicals in the experimental stage of production are also exempted from the GMPR provided that OPA approves the manufacturer's report describing the chemical.



NEW PRODUCTS AND MATERIALS

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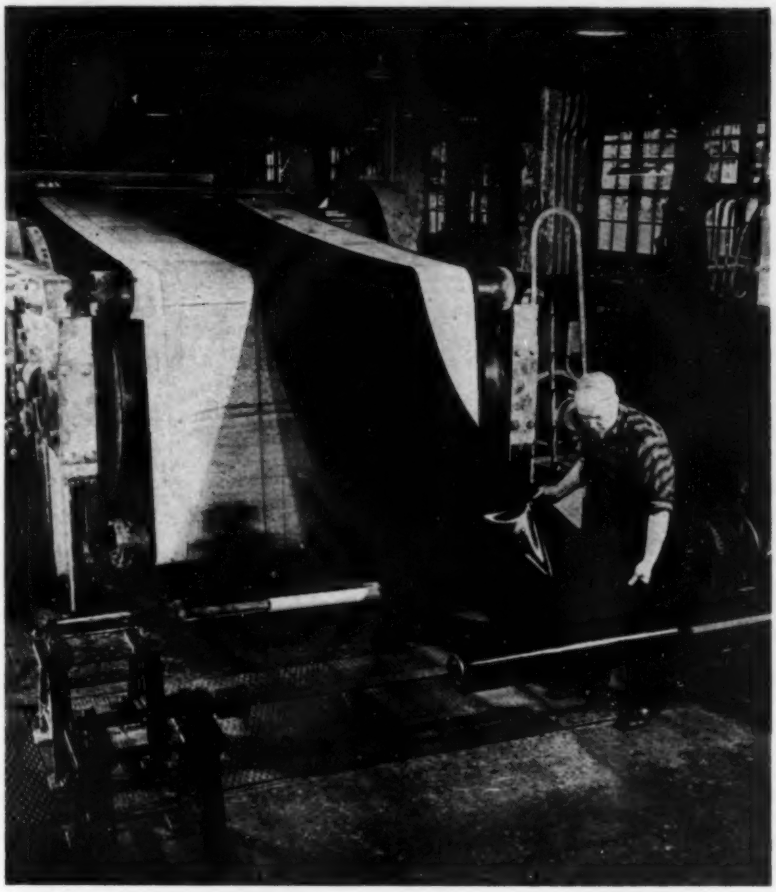


Tank lining leaves curing press. Rough edge is for adhesion of lap

Successful adaptation of the use of concrete tanks for storage of gasoline resulted from development of synthetic linings. Among these is a thin sheet of synthetic rubber, Thiokol FA. This type of lining protects the gasoline from a drop in octane rating and prevents loss of fuel by seepage through porosity in the concrete walls

TEXTILE FINISH

This finish eliminates the objectionable properties and hazards of solvent type agents. It is an aqueous emulsion and can be applied by padding and drying with moderate heat treatment. Although developed by Dupont especially for the Army, such peacetime applications as the treatment of tobacco cloth are indicated when the material is available for civilian uses. The new product is officially called Camouflage Sand No. 3 Finish and Camouflage Olive No. 9 Finish.

COTTON ROPE PRESERVATIVE

With imports of manila fiber for rope cut off by the war, and the government preempting what supply there is, professional and amateur fisherman, yachtsmen and others hesitate to turn to cotton rope. While it has adequate and even superior strength for many purposes, it is inherently soft; organisms in sea water and in some so-called fresh water cause it to deteriorate rapidly.

I. F. Laucks, Inc., 911 Western Ave., Seattle, is bringing out a new formulation, Fungiseal Ready-to-Use Rope Preservative. It is a clear liquid into which the rope is dipped, then dried. Its purpose is not only to protect the cotton fibers against water-borne organisms, but also to stiffen them for added firmness and wear resistance.

CHEMURGIC RUBBER

A new type chemurgic rubber called Witcogum has been developed from vegetable oils by Wishnick-Tumpeer, Inc., New York, N. Y. It is already being used by rubber-goods manufacturers for many essential applications. This rubberlike material, which is comparable to rubber in many of its properties, requires neither critical materials nor critical equipment for its manufacture. Standard rubber mills and mixers do its milling and mixing. Calendering, extrusion and vulcanizing are similar to that of crude and reclaimed rubber. Witcogum contains an accelerator of the granidine type and sufficient sulphur to give a cure in 30 min. at 40 lb. steam pressure (287 deg. F.). Furthermore, all the necessary vulcanizing ingredients are already in Witcogum, though it may be loaded and softened as requirements demand.

It may be used independently or as an extender blended with natural rubber, reclaim or synthetic rubber. Blends with reclaim show promise in extending it. Furthermore, a small amount of reclaim added to a Witcogum compound improves molding and facilitates its removal from tne molds. Softeners may be added to increase tack, improve processing and molding and give a more homogeneous product. The proper compounding of Witcogum with such pigments as carbon black or clay or a combination of both will result in higher tensile strength. Tests have proven that tensile as high as 450 lb. per sq. in. elongation as high as 150 percent, shore hardness of 60-65 and tear of 45-50 lb. per in. can be obtained through proper compounding.

Water, alcohol and lubricating oils have no apparent effect on it, nor do antioxidants upon accelerated aging tests. Generally speaking, its reactions to solvents and chemicals are similar to that of rubber.

SELF-POLISHING FLOOR WAX

A self-polishing type of floor wax both slip-retardant and water-resistant is being introduced by the Finishes Division of E. I. Du Pont de Nemours & Co., Wilmington, Del. Designed as a durable, protective glossy coating for linoleum, asphalt tile, rubber, finished and unfinished wooden floors in homes, offices and institutions, Du Pont Self-Polishing Wax has been extensively tested.

A high percentage of natural carnauba wax combined with a special emulsifying agent contributes qualities of unusual wearability and resistance to water. The new product is easily spread

with applicator, mop or cloth. No rubbing is required and the laboratory-balanced film dries in twenty minutes. The slip-retardant feature has definite value as a safety measure. A high degree of resistance to water reduces the frequency of re-waxing.

PLASTICIZER

TP-90, a new plasticizer for low temperature flexibility has been developed by Thiokol Corporation. This liquid plasticizer works equally well with Thiokol, Buna and other oil-resisting synthetic rubbers.

A second plasticizer, Galex, is a stabilized natural resin in solid form. It is particularly compatible with Buna S. This resin imparts many exceptional properties, particularly greatly improved resistance to flex-cracking.

ELASTIC ALLOYS

Elastic alloys, made from several different types of synthetic rubber blended together to form a material with different properties than any of its components, may well prove to be our rubber of the future according to Dr. S. M. Martin and A. E. Laurence of the Thiokol Corporation.

Reporting to the American Chemical Society on a recently completed study of the properties of the blends of "Thiokol" FA with Neoprene GN, Hycar OR, and Perbunan 26, the Thiokol Chemists found that it was not possible to predict the properties of the blends from the properties and proportions of the synthetics blended. This is illustrated by the fact that such properties as tensile strength, diffusion resistance, low temperature flexibility, and compression set of the elastic alloys do not change as a linear function of the composition of the blend.

Data of a fundamental nature have been acquired on representative stocks for each of the synthetic rubbers tested to establish trends of various properties of the blends. Even though any specific characteristic could be varied within certain limits by formulation changes, the data present useful basic information on the general characteristics of blends to synthetic rubber technologists.

The elastic alloys offer several advantages to the manufacturer of synthetic rubber products. In the first place, they provide a means of formulating stocks with better processing characteristics. Secondly, they open the way for new combinations of physical and chemical properties in finished articles, and finally provide a means of extending any particular synthetic rubber whose supply might be momentarily short.

INORGANIC BASE FINISH

A new type of finish founded upon an inorganic base is known as Silco, and is made by Mitchell-Bradford Chemical Co., Stratford, Conn. Silco adheres tenaciously to steel, brass and chrome plate, is unaffected by a wide range of

solvents, and resists mild alkalis and acids. It is applied by preparing the work free of oil, grease, etc. spraying either manually or automatically. It is dried in oven at 210 deg. F. for 5 min. and baked at 350 deg. F. for 45 min. It is said to be remarkably resistant to abrasion, heat and corrosion. When coated on ferrous metals it has withstood 200 hr. or more in salt spray without breakdown. It is available at the present time in navy-warm drab, army-olive drab, and black. Other colors will be furnished after the war. No priorities are necessary to obtain this material. It withstands heat up to 1,000 deg. F. When properly applied it will not rub off, and is perhaps more rustproof than any other finish that could be applied to such work. It requires only one coat and is, therefore, economical coverage for a number of large fabrications.

THERMOPLASTIC RESINS

New thermoplastic resins with unusual high softening temperatures, low dielectric loss and excellent water resistance, have been announced by General Aniline & Film Corp., New York, N. Y. Properties of Polectron products make them useful in dielectric material for replacement of mica in radio condensers, etc. In tests of Polectron products by standard methods, the following data have been obtained:

Heat distortion temperature.	140–160 deg. C.
Power factor	
One kilocycle to one megacycle at 25 deg. C.....	0.10% or less
At one kilocycle from 25 deg. C. to 100 deg. C..	0.10% or less
Specific resistivity at 400 volts....................	More than 10^{15} ohm cm.
Dielectric Constant (one kilocycle to one megacycle)..................	3.0
Dielectric strength..........	More than 1,000 v. per mil

TOUGH POLYSTYRENE RESIN

The most logical method of producing a tough polystyrene was to copolymerize styrene with some resin which would give to the finished material this desirable characteristic of toughness. However, it was soon ascertained that the resins which would so affect the styrene impaired its electrical characteristics. An alternative method was suggested by reference to the known fact that orientation of large polymers produced increased strength in the direction of orientation. If these orientations could be produced in two directions, a tough flexible sheet would result.

The Plax Corp. developed the first semi-large scale machine to produce this type of flexible sheet. Later, a new large-scale unit was designed, built, and put in production. The electrical characteristics of this new sheet were those of an excellent grade of polystyrene as listed below. From the point of view of physical characteristics, ultimate toughness has not been obtained in the present flexible sheet.

This new polystyrene sheet material, having such excellent dielectric properties, and acid resistance as well, can be employed for such applications as condenser manufacture, cable wrapping, or

thin washers, or windows for electrical purposes. The sheets may also be used to replace hard rubber or mica in some applications. The material is produced in ribbons or sheets in various thicknesses of from 1 or 2 mils up to 20 mils.

ORGANIC ALKYL PEROXIDE

Commercial *t*-butyl hydroperoxide, a new organic alkyl peroxide whose stability and high active oxygen content offer extremely interesting possibilities, is available from Union Bay State Co., Cambridge, Mass. Commercial *t*-butyl hydroperoxide is standardized at a concentration of 50-60 percent (10± percent available oxygen)—and appears to be ideally adapted for use as a catalytic agent in one or two phase polymerizations, as an oxidation agent for laboratory purposes, as a drying accelerator in oils, paints, varnishes, etc., as a combustion accelerator for heavy fuel oils used in diesel engines, as a bleaching agent for cotton, wool and other fabrics, and for numerous other uses.

LEATHER SUBSTITUTES

It is claimed that the new material known as Cottonleather Fabric makes an excellent bottom for shoes of certain types. It consists of cotton fabric of from 2 to 6 plies in thickness which is impregnated with a thermosetting organic binder, cured, calendared and surface ground to resemble leather in color. It is semi-flexible, water repellent and resists oil and heat. The manufacturers, the Southern Friction Materials Co., Charlotte, N. C., report that it has proven highly successful in all types of shoe production. It is available in 4½, 6½, 8½ and 10 iron weights. The widest width is 6 in., reports the *Chemurgic Digest*, April 15, 1943.

PENICILLIN

Penicillin, the latest of the "wonder drugs" to attain popular notice, is as yet more of a problem than a solution. It is apparent now that this material is particularly useful against many infections previously resistant to treatment and appears to be non-toxic, according to the *Industrial Bulletin* of Arthur D. Little, Inc., April, 1943. The problem lies in producing the penicillin and preventing its deterioration. There are recent indications that both of these may be solved in the not too distant future. Although penicillin is effective in extremely high dilution in preventing the development of many disease-producing organisms, it produces no injurious effect on other living cells. Penicillin shares with the sulphonamide drugs an advantage over such commonly used antiseptics as iodine, silver nitrate and bichloride of mercury in that when applied locally it is not fixed at the surface of the wound and may penetrate to the actual sites of bacterial multiplication. It may also be injected in the blood stream or beneath the skin, as well as used locally on wounds, without injuring the normal processes of the

body or preventing the growth of new cells, which is necessary in the repair of wounds and burns. The sulphonamide drugs are inhibited in their action by the presence of pus which is formed by staphylococci, but penicillin is apparently unaffected by pus or any body fluid.

LIQUID WAX FINISH

Operators of fleets of trucks, buses or cars will be interested in Transportation Maintenance Wax, a liquid wax finish manufactured by S. C. Johnson & Son, Inc., Racine, Wis. It is said to protect the finish of automobiles and trucks. It is applied with a compressed-air spray gun, drying to a gloss without rubbing.

SHOE SOLE MATERIAL

New synthetic shoe soles promise to give 50 percent more mileage than grade A sole leather. The shoe sole will be made of tightly woven cotton and impregnated with synthetic resin by Bigelow-Sanford Carpet Co., Inc., New York, as soon as WPB approves. Jule F. Marshall, vice-president of American Felt Co., Glenville, Conn., has invented, tested, and applied for patents on the new "ventile" wool felt insole for shoes to be used in subzero regions. Its foot-warming construction of two layers of perforated felt will be licensed to manufacturers.

FLOOR COMPOUNDS

The fear of slipping on floors can be eliminated, it is said, by the use of AleXitE, the new floor compound formulated by the AleXitE Engineering Co., Colorado Springs, Colo. This material absorbs grease and oil, and at the same time it reduces the danger of skidding on oily floors. It is dielectric, fireproof, light, dry, odorless, clean, and can be swept up and reused many times. When thoroughly soaked with oil it then becomes a dustless sweeping compound. Because of lightness, it covers more space.

TEMPERATURE RESISTANT PLASTICS

Plastic articles which will withstand much higher temperatures than those made from any commercial thermoplastic powder may be made from a new formulation of Lucite molding powder, according to the announcement of Dr. G. M. Kuettel of the Plastics Department, E. I. du Pont de Nemours & Co., Wilmington, Del. This special formulation, called high heat-resistant Lucite, a methyl methacrylate resin molding powder, is a war development. It will be available for numerous peacetime uses. Many articles molded from this new powder will not soften appreciably or distort when exposed to a temperature of 212 deg. F. The new formulation was developed for use in existing compression, injection and extrusion equipment. It is available in granular form for compression molding, and has all the temperature characteristics of the injection or extrusion powder.

CLEANING COMPOUNDS

Cleaning compounds for use in laundries, which it is claimed shorten the wash formula, have been developed by Turco Products, Inc., Los Angeles, Calif. By quickly loosening the soil, a high percentage of it can be rinsed off, making little soap necessary for the finishing rub.

PHOSPHATES

Here are five new phosphates with interesting possibilities as yet unexplored. Four seem to have definite utility in glass, chinaware, porcelains and enamels. One is an excellent source of calcium and phosphorus for mineral enrichment of foods.

While only one of these phosphates is available as yet in commercial quantities the others could be placed in quantity production if sufficient demand develops. For experimental samples, write to: Monsanto Chemical Co., Phosphate Division, St. Louis, Mo.

Aluminum Metaphosphate, $Al(PO_3)_3$

Molecular weight: 263.91
Appearance: white crystalline powder
Melting point: above 1,700 deg. C.
Solubility: insoluble in water, practically insoluble in acids

It might be used as a constituent of glasses, chinaware and porcelains.

Barium Metaphosphate, BaP_2O_6

Molecular weight: 295.40
Appearance: white crystalline powder
Melting point: red heat (about [illegible] deg. C).
Solubility: insoluble in water

The manufacturer suggests two uses for this phosphate; as an opacifying agent in glazes and as a constituent in special types of glass.

Calcium Magnesium Pyrophosphate, $Ca_2Mg_2(P_2O_7)_2$

Molecular weight: 476.88
Appearance: grey powder
Solubility; insoluble in water, soluble in acids
Grade: Technical

In the ceramic industry calcium magnesium pyrophosphate can be used as a constituent of porcelains and enamels.

Calcium Pyrophosphate, $Ca_2P_2O_7$

Molecular weight: 254.20
Appearance: white, non-gritty powder
Odor: none
Taste: none
Melting point: 1,230 deg. C.
Density: 36 to 37 lb. per cu. ft.
Solubility: insoluble in water, soluble in acids

Calcium pyrophosphate can be used as a source of calcium and phosphorus in mineral enrichment of foods.

Magnesium Pyrophosphate, $Mg_2P_2O_7$

Molecular weight: 222.68
Appearance: white crystalline powder
Melting point: 1,383 deg. C.
Solubility. insoluble in water, soluble in acids

Like calcium magnesium pyrophosphate, it may be used as a constituent of porcelains and enamels.

GERM KILLING AGENT

A disinfectant which is said to be 15 times more powerful than phenol as a germ killing agent has been developed by Rampel Chemical Co., New York

N. Y. The new development is known as Perm-Astic-Ramplex. Moreover, the product curbs germ growth with high effectiveness under a wide variety of conditions. It has no odor, no taste, no color. It is non-toxic in the concentration in which it is made available for use in various applications. Tests, according to *Modern Industry*, May 15, 1943, show these properties: germ killing or germ growth inhibiting action equally effective when the substance is in a dry or liquid state, ability to destroy and inhibit growth of bacteria as well as fungi, no deleterious effect on materials treated with it, a high degree of permanence, solubility in water and a variety of other solvents such as ethyl alcohol, glycerine and benzine.

COAGULATION AIDS IN WATER PURIFICATION

A process patent (U.S. No. 2,310,009), for water purification by a special coagulation aid has been granted to Chester L. Baker and Charles H. Dedrick and assigned to the Philadelphia Quartz Co., Philadelphia, Pa. The patent covers a method for preparing a special solution of sodium silicate and a metal salt, which mixture is introduced to raw water prior to the addition of the coagulant. This coagulation aid is for the purpose of inducing a more rapid formation of larger floc, thus removing a higher percentage of the suspended impurities. The silicate-metal salt method has already been used in several water purification plants.

CERAMIC PLASTIC DEVELOPED FOR RADIO TUBE BASES

Faced with the possible shortage of material formerly used in manufacturing bases for high frequency radio tubes for military communication equipment, Heintz & Kaufman, Ltd., South San Francisco, Calif., recently adopted a new material, Prestite, developed by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Made of raw materials found in quantity in this country, this new porcelain is not restricted on priority materials lists. Bases made of Prestite possess satisfactory mechanical and electrical strengths and meet all performance specifications. Tests show that this material has a high dielectric strength and a loss factor better than Navy Grade F requirements. This ceramic has a slightly higher loss factor than material formerly used, but it is found that in the present application the insulation requirement is more than is necessary. Under load tests Prestite bases withstand more voltage than their ratings show. Prestite combines the electrical and mechanical strength of wet process porcelain with the molding qualities of dry process porcelain. It is formed under heavy hydraulic pressure that imparts a dense grain structure, enabling it to stand more electrical, mechanical and chemical abuse than the average ceramic. It is used in many products where intricate shapes must meet high insulation requirements.

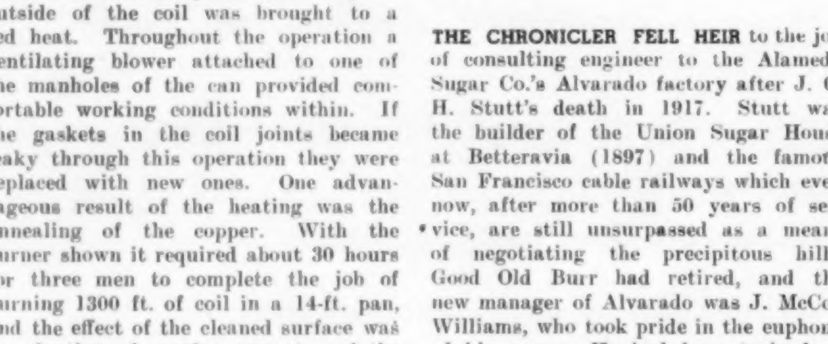
FROM THE LOG OF EXPERIENCE

Dan Gutleben, Engineer

LIBERAL USE OF lubricating oil in steam pump and engine cylinders whose exhaust is used for process, often results in coating the heating surfaces of equipment using the exhaust steam. This naturally reduces the effectiveness of the heat transfer. An insulating coat of oil and carbon is built up on the inside of the sugar pan coils that refuses to respond to any solvent we have tried. Soda, sulphuric and hydrochloric acid, kerosene, gasoline and alcohol can soften the film so that it can be brushed off, but the surfaces are not accessible for brushing. Recognizing that a solvent is required which completely removes the coating, resourceful Rudolph decided to try fire which is an effective solvent for carbon. He therefore inserted a wire-bound twin hose through one of the 4-in. dia. by 75 ft. long coils and fitted the hose with a gas burner at the end. The flame heated the coil as he drew the hose back, but something happened to the gas supply and the resulting explosion sent a helper to the hospital. He then made a torch with a semi-circular hood as shown, and with this, the outside of the coil was brought to a red heat. Throughout the operation a ventilating blower attached to one of the manholes of the can provided comfortable working conditions within. If the gaskets in the coil joints became leaky through this operation they were replaced with new ones. One advantageous result of the heating was the annealing of the copper. With the burner shown it required about 30 hours for three men to complete the job of burning 1300 ft. of coil in a 14-ft. pan, and the effect of the cleaned surface was a reduction of nearly a quarter of the boiling cycle.

When the coil pans were replaced by calandrias in '33, fire was no longer applicable. Then the chemists applied their wits and stumbled onto the idea of using two solutions successively. The first treatment made the film pervious, and the second was then able to penetrate and attack the copper oxide covering of the tubes. When this was dissolved the insulating film fell off. This was a heroic remedy, like the Nebraska farmer's turpentine for a horse afflicted with colic. Some further research and trial and error developed solvents that accomplish the desired result without chilling the marrow of the maintenance engineer's bones when he contemplated the effect of the hydrochloric acid on the metal. Now this is comfortably accomplished as described in John Dittmar's exposition in *Chem. & Met.* for February, 1943, page 137.

After the cleaning, the production cycles for fine granulated sugar were reduced from eighty minutes to sixty minutes. The long cycles of special sugar in one pan were reduced from five hours to four hours. Sugar boiler Jake, desiring to make conversation when Boss W. H. came around, remarked that this should have been done a long time ago. Impatiently, W. H. came back, "Dash-dash it, how in the world could we, when we learned how only last week!"



THE CHRONICLER FELL HEIR to the job of consulting engineer to the Alameda Sugar Co.'s Alvarado factory after J. C. H. Stutt's death in 1917. Stutt was the builder of the Union Sugar House at Betteravia (1897) and the famous San Francisco cable railways which even now, after more than 50 years of service, are still unsurpassed as a means of negotiating the precipitous hills. Good Old Burr had retired, and the new manager of Alvarado was J. McCoy Williams, who took pride in the euphony of his name. He had been trained at Oxnard and had been associated in the building of the Hamilton City factory in 1906. The first job at Alvarado was a new carbonator and sundry plant improvements estimated at $100,000, which was characteristically cut down by the directors to $80,000. Under the connivance of Charley Fleener, Bill Loranger and Ray Stewart of J. McCoy's staff, the job was accomplished within the allowance.

As an aid in stretching the appropriation, the boys dug into the 1887 "graveyard" and unearthed valves and fittings which were sent to the shop for overhaul. The parts possessed a certain antediluvian appearance, having been on the scrap pile since the boiler explosion thirty years earlier, but were made serviceable in the shop nevertheless. There was at hand a brass melting pot and plenty of brass scrap. Bill also mined from the 1887 ruins a pile of asbestos which he puddled into paste, cast into molds for pipe covering and slabs and then dried in the sun. This was the self-same asbestos that fell under the criticism of a German visitor in 1885 when he complained that more compactness in the design of the steam plan would have reduced the length of the steam line and thereby avoided the necessity of asbestos.

Materials were comparatively more difficult to acquire because of the scrutiny of the purchasing agent. However, the control of the workmen was a field adjunct and there were at hand a certain number of perennials who were there "anyway." Furthermore, bookkeeping could not be allowed to stand in the way of an important objective, and so a crew was occasionally abstracted from the farm and transferred to the construction work.

The ranch carried the burden, and flexible old nature entered into the conspiracy by withholding the penalty for temporary neglect of the fields. At the end of the year the directors had a surprise when the factory returns showed how a little kindness caused the old works to respond. Incidentally, the carbonators and the evaporator condenser installed under this program were the only parts reused twenty years later when rebuilding the works.

GREAT DISTRESS EXPLODED over the telephone from the pan floor when Charlie (the "Soop") discovered the thermometer on the steam line. For four years this instrument had been proclaiming the presence of superheat to the amount of 100 deg. in the 35-lb. steam to the pan. "How in the world do you expect me to boil sugar with superheated steam? It can't be done!" Notwithstanding, a million tons of c.p. sugar had been crystallized with this steam since the coils were replaced with calandrias, but the operators did not recognize the superheat until a visiting expert chanced to spy the thermometer. However, this situation had been anticipated by the installation of a little Westco turbine pump arranged to draw condensate from the bottom of the calandria and spray it into the steam pipe just above the inlet. Charlie was shown the starter button and requested to push it and see what happened. Directly he called back to report that the temperature dropped to the saturation point,


From Anhydrous HF

but the steam-flow meter showed no change and there was no increase in the speed of evaporation. In a few days the excitement subsided and contentment returned. Sugar boiling went on as usual, and so did the superheat. The little Westco pump was removed.

Before the last of the coil pans was dismantled in '34, it was tried out with superheated steam just to check up on the assertion of the experts. And, sure enough, they were right. The coils 4 in. in dia. by 75 ft. long behaved as if fed with hot air. The sugar liquor acted like a blanket of hot oil with little ebulition. Cooling air releases a quarter of a B.t.u. for every degree drop in temperature.

When a pound of steam at 35-lb. pressure and saturated temperature of 281 deg. drops a fraction of a degree it condenses and gives up 900 B.t.u. Our 35-lb. steam at its superheat temperature of 381 deg. gives up 51 B.t.u. in dropping 100 deg., and thereafter condenses and releases 900 B.t.u. per pound of steam for a drop of a single degree in temperature. Superheat is a useful vehicle for the economical transport of steam in pipes or through engines, but not for evaporation. However, the calandrias, having an area of 4,000 sq.ft. of vertical tubes against 1300 sq.ft. of air-locked coils, doubtless condense some steam instantly upon entrance and thereby provide moisture for the continuous desuperheating.

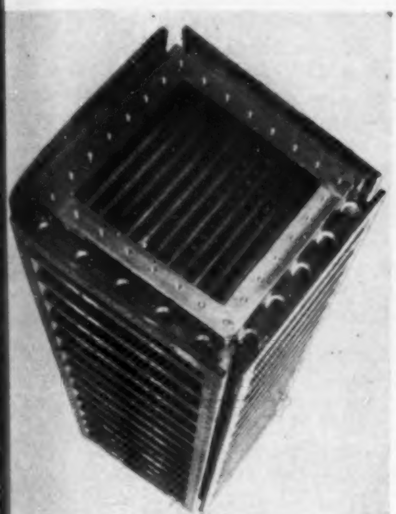
THE HEAT EXCHANGER illustrated was first built of steel and used for cooling CO_2 gas as well as compressed air. The cooling water passes through the easily cleaned tubes while the gas meanders counter-current through the shell.

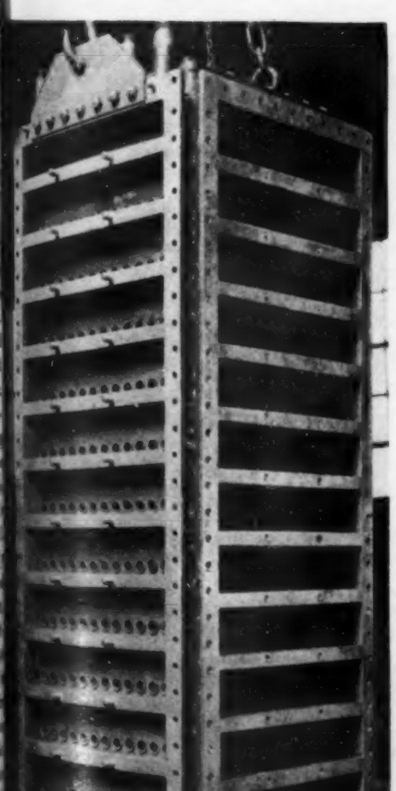
The same device was thought to have special merit as a heat exchanger for molasses, as this cantankerous material can convulse with little head loss through the tortuous path outside the tubes while the hot waste water from the condensers passes through the tubes. Four of them, therefore, were built of bronze, each consisting of four cast sides welded together at the corners. The first one heated the molasses "patiently" without caramelizing, using waste water from the condenser. The second raised the molasses to the pasteurizing temperature, using condensate en route from the traps to the hot well.

The operation proceeded satisfactorily for a period as the molasses was washed out at the end of every cycle. However, on one occasion, by operating forgetfulness, the hot condensate at about 240 deg. was allowed to continue to circulate through the tubes while the molasses flow through the shell was shut off. The result was a heavy deposit composed of lime salts and carbon that responded not a whit to any liquid solvent that was tried out. But the deposit was found to be soluble in fire and left a fluffy ash which lost its ambition to stick.

Operator Stetson thereupon circulated warm water vigorously through the copper tubes and ignited the deposit on the outside by the aid of a little excelsior

nd a current of air, the air being regulated from a hose to suit the maximum rate of carbon dissolution that was considered not too dangerous! The smoldering continued for a period of four days, accompanied by the evolution of a vile odor that penetrated up through the distillery. When all of the carbon had been dissolved the tubes were as clean as an Ethiopian's heel, and the original heat transfer coefficient of about 140 B.t.u. per hr. per sq.ft. per degree of average temperature difference was restored.





PERSONALITIES

Allied News

C. E. Fritsche

A. G. Olsen

✦C. E. FRITSCHE, vice president of Reichhold Chemicals, Inc., is in charge of operations at the company's Tuscaloosa, Ala., plant. It is expected that the plant will be completed soon.

✦HENRY F. SCHIPPEL, of The B. F. Goodrich Co., Akron, Ohio, has returned to the United States after nearly a year in Africa where he was project engineer in charge of rubber products at two large American repair and maintenance bases.

✦E. D. YOUMANS has been elected to the position of vice president and technical director of The Okonite Co., and the Okonite-Callender Cabe Co., Inc.

✦JOHN W. HADDOCK has been elected president of Farrel-Birmingham Co. of Ansonia, Conn. and Buffalo, N. Y. Mr. Haddock was formerly vice president of the Sullivan Machinery Co., Claremont, N. H. and Michigan City, Ind.

✦E. W. POTTER has been elected president and general manager of Mid-West Refineries, Inc., Grand Rapids, Mich. Mr. Potter came with Mid-West in March 1940 as executive vice president. He was formerly connected with Universal Oil Products Co. and Cosden Petroleum Corp. V. M. SKINNER was elected vice president and sales manager. He is a native of Michigan and has been associated with Mid-West Refineries, Inc., since 1934.

✦LEWIS W. WATERS, formerly vice president in charge of research and development for General Foods Corp., has been appointed to the newly created post of vice president in charge of scientific relations.

✦JOHN M. SHIMER has been appointed to the post of research engineer with the Cooper-Bessemer Corp., Mt. Vernon, Ohio. He will be located with the company's Dallas, Tex., office.

✦A. G. OLSEN has been appointed assistant manager of General Foods Central Laboratories at Hoboken, N. J. He will continue as director of the food technology section of the Laboratories.

✦DONALD H. POWERS has joined the staff of Merrimac Division of Monsanto Chemical Co. as specialist on applications of the company's chemicals in the textile industry. Although his headquarters will be in Everett, Mass., Dr. Powers will serve as a consultant for all Monsnato divisions on textile applications.

✦GEORGE W. DEBELL has opened his own offices at Stamford, Conn., where as a consulting engineer he will specialize in all types of plastics engineering. He leaves the Thomas Mason Co., where he has been employed for the past two years as chief engineer in charge of product design.

✦R. E. BENSON, formerly with National Aniline Division of Allied Chemical & Dye Corp., has joined the Benson Process Engineering Co., Eden, N. Y., to serve as technical director of the consulting and development laboratories and as coordinator for the associate members of the company.

✦DAVID DICKINSON, formerly with the Maytag Co., has joined the Benson Process Engineering Co., Eden, N. Y., in the capacity of physicist and engineer.

✦A. E. BEDELL has been appointed chief engineer of Graver Tank & Mfg. Co., Inc., in charge of engineering and development covering all divisions of the company. He was formerly associated with Max B. Miller & Co. His headquarters will be at the general offices of the company, East Chicago, Ind.

✦CHARLES F. ROHLEDER has been appointed factory superintendent of Maas & Waldstein Co., Newark, N. J. Mr. Rohleder, who has held the position of chief chemist of Maas & Waldstein since 1937, was graduated from Cooper Union in 1926 with the degree of B.S. in chemistry.

✦LAWRENCE W. WALLACE, vice president of the Trundle Engineering Co., Cleveland, was given an honorary degree of doctor of engineering by the Agricultural & Mechanical College of Texas, College Station, Tex., at the commencement exercises held there recently. The honorary degree conferred in recognition of Mr. Wallace's outstanding contribution to engineering science and to the cause of engineering education is the second which he has received. He was given the honorary degree of doctor of engineering by Purdue University in 1932.

✦GRANT B. SHIPLEY has been appointed chairman of the board of directors of the Elliott Co. He has had a long and successful industrial experience, having started in the shop as a mechanic. He organized several enterprises of which he was president and chairman.

✦MAURICE L. TAINTER, professor of pharmacology at Stanford University and at the College of Physicians and Surgeons, San Francisco, has been named research director of Winthrop Chemical Co. Dr. Tainter will make his headquarters at the company's plant and laboratory at Rensselaer, N. Y.

✦JOHN C. STRANGE has resigned as chief of the War Products Development Section, Pulp and Paper Division, W.P.B. Mr. Strange, who set up the War Products Development Section and has acted as its chief ever since will be succeeded by R. J. ZAUMEYER, of Neenah, Wis. Mr. Strange will return to his duties as secretary of the Institute of Paper Chemistry, at Appleton, Wis. but will continue to serve as a consultant to the section of the development of some of the forty special paper projects designed to meet war requirements.

✦FRANK K. SCHOENFELD has been named technical superintendent of the chemical division of The B. F. Goodrich Co. Dr. Schoenfeld goes to his new post after many years of specializing in the development and application of Koroseal. He has been for several years in charge of the Koroseal research and development laboratories. In his new post he succeeds DR. ROBERT V. YOHE, recently named manager of the Kentucky synthetic rubber plant operated by the company for the government.

✦JUDSON C. TRAVIS, formerly assistant to the president of Handy & Harman and recently elected to the board of directors to replace H. H. DELOSS, de-

ceased, was elected vice president in charge of sales.

✦ Julian W. Nash, chemical engineer, has been appointed to the research staff of Battelle Memorial Institute, Columbus, Ohio, and assigned to its division of non-ferrous metallurgy. Mr. Nash, a graduate of West Virginia University, was formerly associated with the Alexite Engineering Co., Colorado Springs, Colo., and prior to that held chemical engineering positions with the U. S. Department of Agriculture and the E. I. du Pont de Nemours & Co. Among the other recent additions to the staff of Battelle Memorial Institute is Louis C. Beale, a recent graduate in chemical engineering from Ohio State University, who has been appointed to the research staff of Battelle. A new appointee to the electrochemical research division of Battelle is Harold F. Haase, chemical engineer, a graduate of the University of Wisconsin and the Massachusetts Institute of Technology, and Marquette University. In the division of chemical research at Battelle is Basil H. Minnich, a chemical engineering graduate of Ohio State University. Mr. Minnich has held positions with Standard Oil Co. of Ohio and the Ashland Oil and Refining Co., Ashland, Ky.

✦ J. V. N. Dorr received an honorary degree of Doctor of Science from Columbia University on June first.

✦ Gustav Egloff, director of research of Universal Oil Products Co., was the 1943 recipient of the Columbia University Medal of Merit which is awarded annually to an outstanding scientific or technological leader in industry.

✦ Julian S. Gravely, an executive of the Western Cartridge Co. until he resigned recently, is now president of the Beryllium Corp. and the Beryllium Corp. of Pennsylvania. Mr. Gravely has his headquarters at Reading, Pa., where the manufacturing plants are located.

✦ H. W. North has joined the Aircraft Division of Odin Stove Mfg. Co. as consulting engineer. He was formerly with the Austin Co.

✦ Robert D. Thompson has been appointed manager of a new glass products engineering division of The Taylor Instrument Cos. Dr. Thompson has been engaged in research work on glass products with Taylor following a year as a research fellow in the Heat and Power Division of the National Bureau of Standards.

OBITUARIES

✦ Frederick Kershaw, President of Proctor & Schwartz, Inc., died at his home last month after an illness of several weeks. He was 58 years old and had been associated with Proctor & Schwartz since 1898.

✦ Hamilton P. Cady, professor at the University of Kansas and pioneer in the development of helium resources, died May 26. His age was 68.

+FRANCIS J. MCDONOUGH died May 31 at his home in Brooklyn. He was 54 years old. For 18 years he was President of New York Quinine and Chemical Works, and for many years he was active in the affairs of the drug and chemical industry.

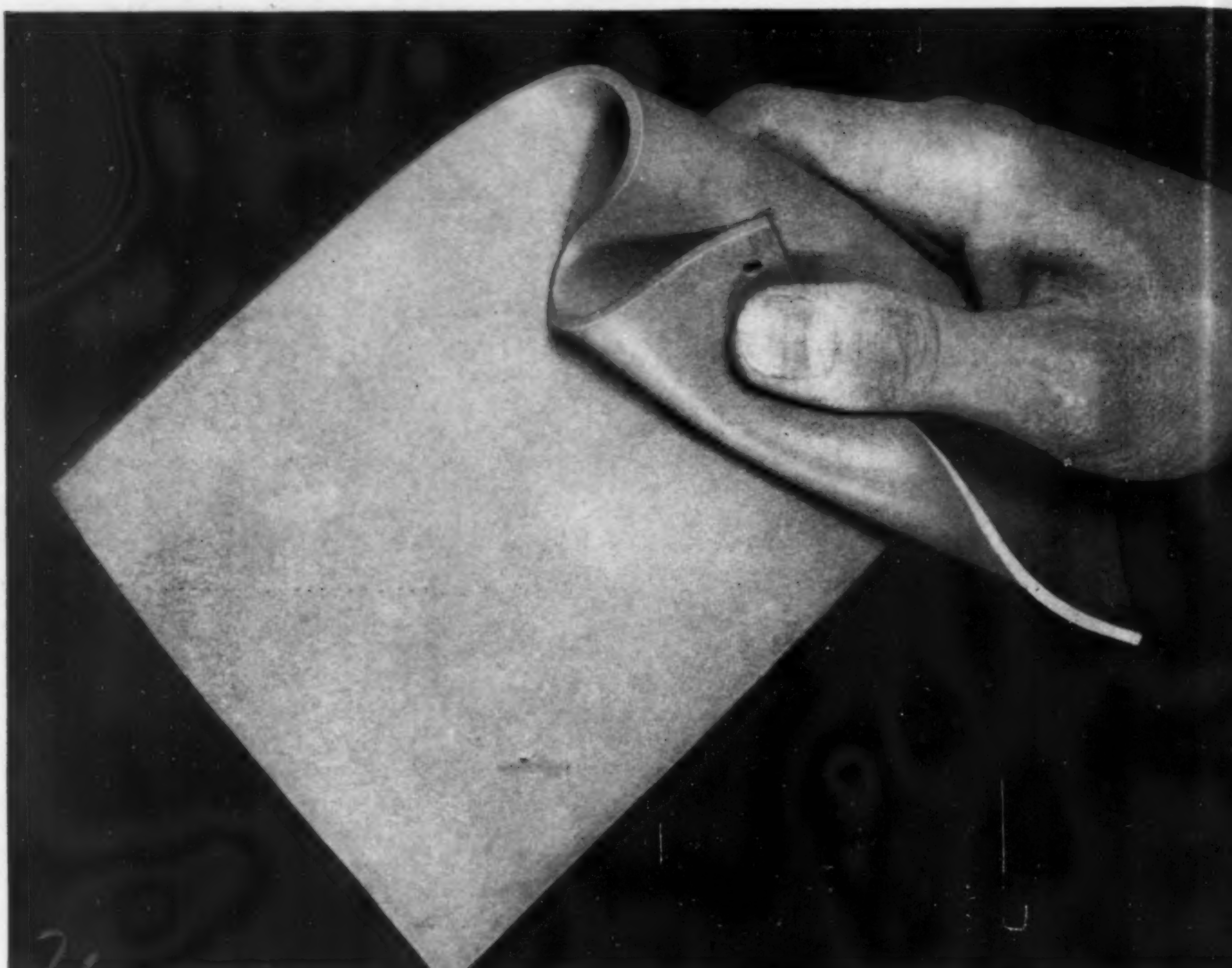
+JOSEPH W. HAYS, founder of what is now The Hays Corp., died at the family home in Grinnell, Iowa, on April 22 at the age of 75.

+ALBERT L. AUSTIN, sales engineer of Robins Conveyors Inc., Passaic, N. J., passed away on May 2 after a protracted illness. Mr. Austin joined the mead-Morrison Mfg. Co., as draftsman in the late summer of 1915. When Robins took over the coal and ore handling products of Mead-Morrison in 1934, Mr. Austin became a Robins sales engineer.

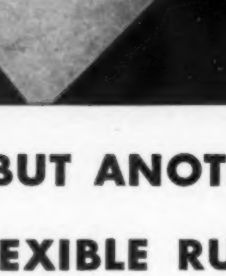
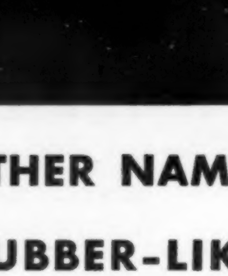
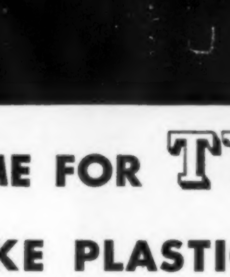
+ROBERT M. CASTLES of Short Hills, N. J. died April 22 in Wagner Hospital from injuries sustained in an explosion in the Rohm & Haas plant at Bristol, Pa. He was employed as a chemical engineer. He was graduated Feb. 1 from Massachusetts Institute of Technology.

Edwin M. Baker

+EDWIN M. BAKER, professor of chemical engineering, at the University of Michigan, Ann Arbor, and a chemical engineering consultant, died in New York May 26. He had suffered a heart attack a week previously from which he did not recover. Mr. Baker was born in 1893 and was graduated from Penn. State College in 1916 with a Bachelor of Science degree in electrochemical engineering. He joined Hooker Electrochemical Co., at Niagara Falls and remained with that organization until September, 1918. At that time he joined the University of Michigan as an instructor in the department of chemical engineering. He became assistant professor in 1920 and later associate professor. He has been full professor since 1933. As a co-author with W. L. Badger, he will be remembered for the authorship of "Inorganic Technology." For many years he has been one of the countries outstanding electrochemists and served as president of the Electrochemical Society in 1942-43.






MEETINGS AND CONVENTIONS

DU PONT URGES POSTWAR PLANNING

Addressing the Manufacturing Chemists' Association at its annual meeting in New York June 3, Lammot Du Pont, chairman of the board of E. I. Du Pont de Nemours & Co., said that practical postwar planning with "one doing the planning of one's self—the individual for the individual, the small company for the small company, and the corporation for the corporation"—should bring about the highest peacetime employment in the nation's history.

Mr. Du Pont revealed that his own company's postwar planning group had made a survey which "indicates that the new projects which Du Pont will be ready to launch when the war is over, together with increased outlets for existing products, are expected to give rise to an all-time high in peacetime employment by the company." Although the United States will have the greatest productive capacity in its history when peace comes, the task of swinging this capacity from the channels of war to those of peace will be fully as titanic as was the conversion of a peaceful nation into the "arsenal of democracy."

All these assumptions, Mr. Du Pont pointed out, were based upon certain fundamentals being respected, for instance, (1) sound money based preferably on the gold standard, (2) taxes at such a level as to give industry the incentive to expand and pioneer, and (3) that government will abstain from competition with business.

Officers reelected by the Manufacturing Chemists' Association were as follows: H. L. Derby, president; Lammot Du Pont, chairman of the executive committee; J. W. McLaughlin, vice president; and W. M. Watson, secretary. New members added to the executive committee include W. S. Landes, vice president of Celanese Company of America; H. M. Hooker, president of Hooker Electro Chemical Co., and S. Sharples, pres., Sharples Chemical Co.

A.I.Ch.E. PASSES RESOLUTION ON DRAFTING OF CHEMICAL ENGINEERS

At its semi-annual meeting in New York during May, members of the American Institute of Chemical Engineers discussed deferment of essential technical personnel in war industries. The report of the Technical Manpower Committee, under the chairmanship of S. D. Kirkpatrick, led to the passage of the following resolution:

"The members of the American Institute of Chemical Engineers present at the Institute's 35th semi-annual meeting in New York City, May 10, 1943, by unanimous vote, express their belief that many of the existing difficulties incident to the determination of the desirability of deferring chemical engineers and chemists engaged in essential chemical and related industries would be overcome by appointment of an advisory committee to the War Manpower Commission, which would achieve the objectives of the advisory committee on the deferment of physicists set up under W.M.C. Local Board Release No. 159; and concur in the request recently made by the Board of Directors of the American Chemical Society, that a separate advisory committee, restricted in its recommendations to chemical engineers and chemists, be appointed."

SOCIETY OF PLASTICS INDUSTRY ELECTS NEW OFFICERS

At its annual meeting in Chicago on May 13-14, the Society of Plastics Industry elected the following officers to serve during the coming year: chairman, Ronald Kinnear; president, George Scribner; vice-president, Howard Bunn, and secretary-treasurer, H. H. Wanders. Newly elected directors included Horton Spitzer, William Joslyn, James Neal, W. M. Phillips, J. D. McDonald, O. W. Marsh, M. G. Milliken, F. A. Morlock, Carl Hitchcock, W. J. McCortney, and A. E. Byrne.

INDUSTRIAL RESEARCH INSTITUTE HOLDS ANNUAL MEETING

The Industrial Research Institute completed five years of activity with its recent annual meeting in New York on May 21-22. Seventy industrial executives and research directors, representing member companies and their guests, attended the meeting and participated in informal conferences. Organization of research in Great Britain and the United States, its support of the war effort and probable postwar trends, was discussed. Dr. G. S. Whitby, recently of the department of scientific and industrial research, Teddington, England, presented the British picture and Dr. Robert W. King, American Telephone & Telegraph Co., discussed the situation in this country. Further sessions were devoted to discussions of new research tools in the field of chemistry, industrial research management problems and rating of research personnel.

William R. Hainsworth, vice president, Servel, Inc., New York, was elected chairman of the Institute's Executive Committee for the coming year, and Harold K. Work, manager of research and development division, General Metallurgical Department, Jones & Laughlin Steel Corp., Pittsburgh, was elected vice chairman. Three new members of the committee were also elected for three-year terms. These were A. Griffin Ashcroft, Ralph T. K. Cornwell, and John M. McIlvain.

CHEMICAL SHOW TO BE HELD IN MADISON SQUARE GARDEN

Date for the 19th Exposition of Chemical Industries has been definitely set for the week of December 6–11, 1943, according to C. M. Roth, manager of the exposition. However, this year Madison Square Garden will be the scene of the event instead of Grand Central Palace, since the U. S. Army has commandeered the exposition floors of the Palace. All exhibition space at Madison Square Garden will be on one floor. The actual amount of space available will be approximately 50 percent that of the 1941 exposition, and booth sizes will vary. A diagram of the floor plans is now being prepared by the International Exposition Co., 480 Lexington Ave., New York, N. Y.

CONRAD ELVEHJEM RECEIVES WILLARD GIBBS MEDAL

The 32nd Willard Gibbs medal has been presented by the Chicago section of the American Chemical Society to Conrad A. Elvehjem, professor in agricultural chemistry at the University of Wisconsin. The presentation was at the May 20 meeting of the section.

The recipient was cited for his work on vitamins and nutrition, and especially for his research in the field of the B vitamins. C. Glen King, scientific director, Nutrition Foundation, Inc., spoke of the medalist and his achievements, while Per K. Frolich, president of the American Chemical Society, presented the medal. Dr. Elvehjem then spoke on "Nutritional Significance of the Newer Members of the B-Complex."

DOW RECEIVES CHANDLER MEDAL FROM COLUMBIA UNIVERSITY

Willard Henry Dow, head of the Dow Chemical Co., Midland, Mich., has been chosen by Columbia University as recipient of the Chandler medal for this year. The medal was presented to Dr. Dow at Columbia University, May 20, at which time he delivered an address on "Rediscover the Rainbow."

Dr. Dow was chosen for his dynamic and successful leadership in the American chemical industry. In addition to his accomplishment in expanding a chemical industry from Michigan salt brines, his daring enterprise in the extraction of bromine and of magnesium from sea water as well as the production of synthetic plastics and synthetic rubber have all attracted world-wide attention.

CANADIAN CERAMIC INDUSTRY APPOINTS ADVISORY BODY

A ceramic advisory committee has been formed by the Canadian ceramic industry to assist in an advisory capacity to the Conservation Committee of the Department of Munitions and Supply, Ottawa, and to study possibilities of extending the line of ceramic products so as to conserve metals and other critical

materials or to replace commodities of which there is a shortage. The Advisory Committee is under the chairmanship of Howells Frechette, chief of the Industrial Minerals Division, Bureau of Mines, Ottawa.

ELECTROCHEMICAL SOCIETY TO HOLD CONVENTION DURING OCTOBER

The next convention of the Electrochemical Society will be at the Hotel Pennsylvania, New York, Oct. 13–16, 1943. Lincoln T. Work, director of research, Metal & Thermit Corp., heads the New York local committee. Among the special items on the program will be the Joseph W. Richards' memorial lecture by B. D. Saklatwalla.

There will be one session on "Electro-Organic Chemistry" and two sessions on "Electrodeposition." James A. Lee, managing editor, *Chem. & Met. Eng.*, reports twelve manuscripts promised on the subject of "Electroplating Strip Steel." In the electro-organic field, H. Germain Creighton urges members and guests to submit manuscripts on electrolytic oxidation and electrolytic reduction of organic compounds and in particular on organic reactions in the electric discharge tube.

TEXTILE CHEMISTS CANCEL ANNUAL MEETING

In compliance with the restrictions on traveling imposed by the Office of Defense Transportation, the Council of the American Association of Textile Chemists and Colorists has again voted to abandon plans for an annual meeting this year. Nevertheless, demand for continuation of the intersectional technical contest has been so persistent that this event will be held. Papers contributed by sections of the Association will be submitted at a fall meeting of the New York Section, the date of which will be announced later.

CORROSION COMMITTEE ISSUES DIRECTORY

The American Coordinating Committee on Corrosion is revising its confidential directory of technologists actively engaged in studies on corrosion and its prevention. The committee comprises delegates from 15 major technical societies together with representatives from the principal research institutes and the National Bureau of Standards. Its directory currently lists some 450 investigators in a diversity of corrosion-preventive fields, selected on the basis of questionnaires. The committee now requests all persons engaged in corrosion researches who have not been contacted to write to the secretary, Dr. G. H. Young, 4400 Fifth Ave., Pittsburgh, Pa., for further details and application form.

GIBSON ISLAND CONFERENCES UNDER WAY

The sixth summer research conferences on chemistry and allied fields under the auspices of the American Association for the Advancement of Science are now under way, lasting from June 14 through August 16. Conferences scheduled include those on "Frontiers in Petroleum Industry," under the chairmanship of R. E. Burk; "Catalysis," under Hugh S. Taylor; "Organic High Molecular Weight Compounds," under H. Mark; "Strategic Materials," under Robert Calvert; "Vitamins," under R. Adams Dutcher; "Corrosion" under R. B. Mears and "Instrumentation" under John J. Grebe.

Requests for attendance or other additional information should be addressed to the director of the conferences, Neil E. Gordon, chemistry department, Wayne University, Detroit, Mich.

CONSULTING CHEMISTS AND CHEMICAL ENGINEERS DISCUSS KILGORE BILL

Relative merits of Kilgore Bill S. 702 were discussed by members of the Association of Consulting Chemists and Chemical Engineers, Inc. at the April meeting of this organization in New York.

Certain features of the bill were defended by A. P. Sachs, vice president of the Association of Consulting Chemists and Chemical Engineers, and by B. L. Oser, Food Research Laboratories, Inc. Opposition was voiced by Preston S. Millar, president, Electrical Testing Laboratories, Inc., C. O. Brown, consultant, and Nicholas M. Molnar, Molnar Laboratories.

SELECTIONS FROM CONVENTION PAPERS

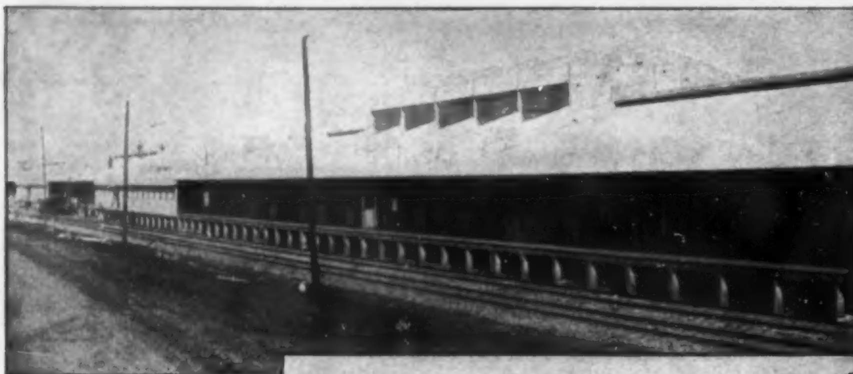
CONTAMINATION BY SUCCESSIVE FLOW IN PIPE LINES

In the transportation of different fluids in pipe lines, it is customary to pump one product immediately after the other. This leads to contamination of a portion of the material delivered from the far end of the pipe line. Experimental work has been done in the laboratory under conditions where the contaminated portion may be determined with much greater precision than is possible in commercial lines. Fluids used consisted of water and salt solution of almost identical physical properties covering viscosities from about 0.8 to 1.5 centipoises, Reynolds numbers from less than 200 to 19,800 and length-diameter ratios from less than 200 to over 10,000.

In the laminar flow region the contaminated portion was found to be independent of Reynolds number, as is indicated by a theoretical analysis. In turbulent flow the contaminated portion may be computed by the following equation:

$$\log_{10} (\textit{contaminated portion}) = \log_{10} (\textit{pipe vol.}) - 0.4 \log_{10} \frac{L}{D} + c$$

where c is a function of Reynolds number and range in instantaneous composition defining contaminated portion.



The above equation can be applied to commercial pipe line data covering the transportation of oil products, using the average Reynolds number of the two products in the above equation. The commercial data cover viscosities varying from 0.51 to 7.4 centistokes, corresponding to Reynolds numbers from 27,000 to 610,000 (average Reynolds numbers from about 55,000 to 537,000) and length-diameter ratios from 437,000 to 1,765,000.

Frank C. Fowler, Phillips Petroleum Co., Bartlesville, Okla., and G. G. Brown, University of Michigan, Ann Arbor, Mich. before the American Institute of Chemical Engineers, New York, N. Y., May 10-11, 1943.

GLUTAMIC ACID CONTENT OF STEFFEN'S WASTE FROM BEET SUGAR PRODUCTION

Glutamic acid or sodium glutamate, much in demand as a condiment, can be made from Steffen's waste. Variations in the glutamic acid content of Steffen's waste from various parts of the country having been noted, attempts were made to determine the variations and, if possible, to explain them.

On a comparative basis using wastes concentrated to a specific gravity of 1.4, 500 grams of the concentrated waste yielded the following amounts in grams: Tracy, Calif., 30.75; Mason City, Iowa, 30.7; St. Louis, Mich., 28.95; Freemont, Ohio, 27.05; Grand Island, Nebr., 21.92; Spanish Fork, Utah, 18.4; Loveland, Colo,. 17.57. Smaller amounts were obtained from Swink, Colo., 10.65; Fort Morgan, Colo., 10.9; Ovid, Colo., 9.55; Worland, Wyo. 6.05.

While no glutamic acid or very little was obtained from samples from Colorado prior to 1938, either because of a more accurate method or because of a variation in seasonal conditions, considerable glutamic acid was obtained from the present Colorado samples. The highest yields of glutamic acid were obtained from samples procured from factories located in the midwestern states and in California.

Wastes from Iowa, Michigan, Ohio, and California should be chosen as a commercial source of glutamic acid.

David W. O'Day and Edward Bartow, The State University of Iowa, Iowa City, Iowa, before the 105th annual meeting of the American Chemical Society, Detroit, Mich., April 12-16, 1943.

ISOTHERMAL AND ADIABATIC FLOW OF COMPRESSIBLE FLUIDS

In pipe lines handling compressible fluids at high pressure drops, the flow conditions are usually intermediate between isothermal and adiabatic, depending on the flow rate, the degree of pipe insulation, and the length of pipe. A graphical presentation has been prepared to give a direct quantitative comparison of the effect of adiabatic and isothermal flow conditions on mass discharge rates through such pipe lines.

It is shown that the mass discharge rate through a given pipe line at a specified pressure drop for adiabatic flow conditions is, in general, greater than for isothermal flow conditions but will never be more than 20 percent greater

and will be practically the same as for isothermal flow conditions for pipes more than 1,000 pipe diameters long. The adiabatic flow equations will reduce, as is necessary, to the corresponding isothermal flow equations if the value of k (ratio of specific heats), appearing in the adiabatic flow equations, is set equal to unity. Design charts have been drawn up for various values of k, and comparisons of the theoretical curves with available literature data show excellent agreement.

C. E. Lapple, E. I. du Pont de Nemours & Co., Wilmington, Del. before the 35th semi-annual meeting of the American Institute of Chemical Engineers, New York, N. Y., May 10–11, 1943.

CHEMICAL PROCESS INDUSTRIES AFTER THE WAR

WHETHER the war drags on for several years or comes to a fairly early conclusion, careful thought must now be given to the question of post-war trends and possibilities. If the war should be protracted, tentative conclusions regarding future developments will obviously have to be resurveyed at intervals. But in order not to be caught unaware if a sudden ending of the conflict should come, it is advisable to make now some preliminary investigations at least along broad lines. Management must continually carry on long-range planning.

Electrochemical Industries—These industries have been enormously stimulated by the war program and by the construction of Bonneville, Boulder, Grande Coulee and the dams near Muscle Shoals. If the Federal Power Commission has its way the present generating capacity of the country of 50,000,000 kw. will soon be pushed up to 62,000,000 kw.

Much of this power will be used by our aluminum industry, which is planned to have an ultimate capacity of 3,000,000 lb. or almost ten times the 1939 figure. Magnesium production at the close of 1942 was at the rate of 260 million pounds. Ultimate capacity is now planned at 600 million pounds, or almost 100 times the 1937 output. Almost anything that flies, runs, moves, or is otherwise mobile or motive will offer a potential market for these light metals and their alloys. But they will have increasing competition from plastics and from high strength, low-alloyed steels.

In 1939 this country produced 485,000 tons of chlorine, and last year's output is believed to have been over 1,000,000 tons. Additional capacity which has since been completed will raise the figure in 1943 to 1,200,000 tons. One of the largest users of chlorine is the organic solvents industry. In 1942, some 200,000 tons of chlorine were used for production of trichloroethylene, carbon tetrachloride, tetrachloracetylene, ethylene dichloride, and other chlorinated hydrocarbons.

Another interesting electrochemical development is the improved plating process for strip steel for fabrication at speeds 100 times faster than those in the past.

Use of Aluminum by Industry

	Nov. 1939	May 1942	Estimate After World War II
Transportation ..	29%	63%	34%
Cooking utensils.	14	1	10
Electrical conductors	10	0	8
Machinery and electrical appliances	15	6	12
Building construction	8	3	9
Chemical	5	5	5
Foundry and metal working.	4	19	9
Ferrous and nonferrous metallurgy	5	2	4
Food and beverages	6	0	5
General miscellaneous	4	1	4

Heavy Chemicals—Commodities like ammonia and nitric acid as well as phenol have been greatly stimulated by war demands and will recede unless important new uses not now in sight are developed for postwar exploitation. Sulphuric acid, soda ash and caustic soda have expanded plant capacities of 12 to 15 percent over 1941.

Nitric acid may well be in for a nose dive unless the present slow trend toward more concentrated fertilizers opens up a more promising outlet for ammonium nitrate and ammnoium phosphate. Organic nitrated materials, such as the nitroparaffins, have interesting possibilities but do not yet loom large as acid consumers.

Synthetic Organic Chemicals—This industry undoubtedly will emerge from the war period with greatly expanded capacity, improved raw materials and processes, and hungry for new and larger markets. The war has definitely proved that the industry can "tailor-make" its products to fit practically any specification of properties and performance. Organic chemical engineering is the engineering of the future.

Last year this industry set an all-time peak in production and is expected to gain another 25 or 30 percent in 1943. Coal-tar crudes and intermediates, especially those destined for plastics, rose sharply. Synthetic medicinals showed an outstanding development that seems certain to continue to gain momentum.

The solvents industry will undoubtedly encounter many postwar problems. With ethyl alcohol production up five times the largest output in normal times, with more isopropyl than we formerly had of ethyl, with methanol up 50 percent and toluol and benzol production skyrocketting, it is certain that the industry will have to look for new fields to cultivate. Fortunately, synthetic rubber, resins and plastics are going to need much larger volumes of solvents than ever before. Fortunately, too, in the case of ethanol is the fact that fully half of its production is coming from the whisky distillers, who presumably will revert to their own business after the war.

Plastics and Resins—Plastics will undoubtedly be put on the market at lower prices after the war. The backbone of this industry in prewar days was the larger number of applications calling for comparatively small quantities. The

war, however, has shown that large volumes of materials will completely overshadow the small outlets. Already the industry is talking in tons, and last year production exceeded 200,000 tons. This is insignificant when compared with 100,000,000 tons of steel, but when it is put alongside of 300,000 tons of magnesium, 75,000 tons of tin or 600,000 tons of zinc, and when it is realized that plastics are lighter than all metals except aluminum and magnesium, we get a better basis for talking about the "Plastics Age."

James A. Lee, managing editor, *Chemical & Metallurgical Engineering*, before the Chicago Section of the Electrochemical Society, Chicago, Ill., March, 1943.

HYDROGENATION AND LIQUEFACTION OF COAL

MEASUREMENTS were made of rates of hydrogen utilization; of oxygen, nitrogen, and sulphur removal; and of coal liquefaction at temperatures in the range of 310-430 deg. C. at about 180 atmospheres pressure of hydrogen in presence and absence of a catalyst. These tests were made in 1200-cc. rotating autoclaves using Pittsburgh bed coal in all cases except when the effect of rank was being studied.

Chief function of the catalyst is to increase the rate of regeneration of a hydrogen carrier which is a hydroaromatic compound such as tetrahydronaphthalene. Reactions of the hydrogen carrier with oxygen and unsaturated groups in the coal are largely noncatalytic. Effects of the catalyst on rate of oxygen elimination and liquefaction are similar.

Rates of hydrocarbon gas formation show similar variations in temperature coefficients. The latter indicate that the rate-determining step changes with temperature. Below 300 deg. C. it is apparently a chemical reaction between a hydrogen carrier and unsaturated groups in the coal; between 310-355 deg. C. diffusion of hydrogen through liquid films on the surface of the coal and catalyst is the slowest step. Between 355-370 deg. C. the diffusion rate surpasses that of primary thermal decomposition of the coal substance and the latter becomes the rate-controlling process.

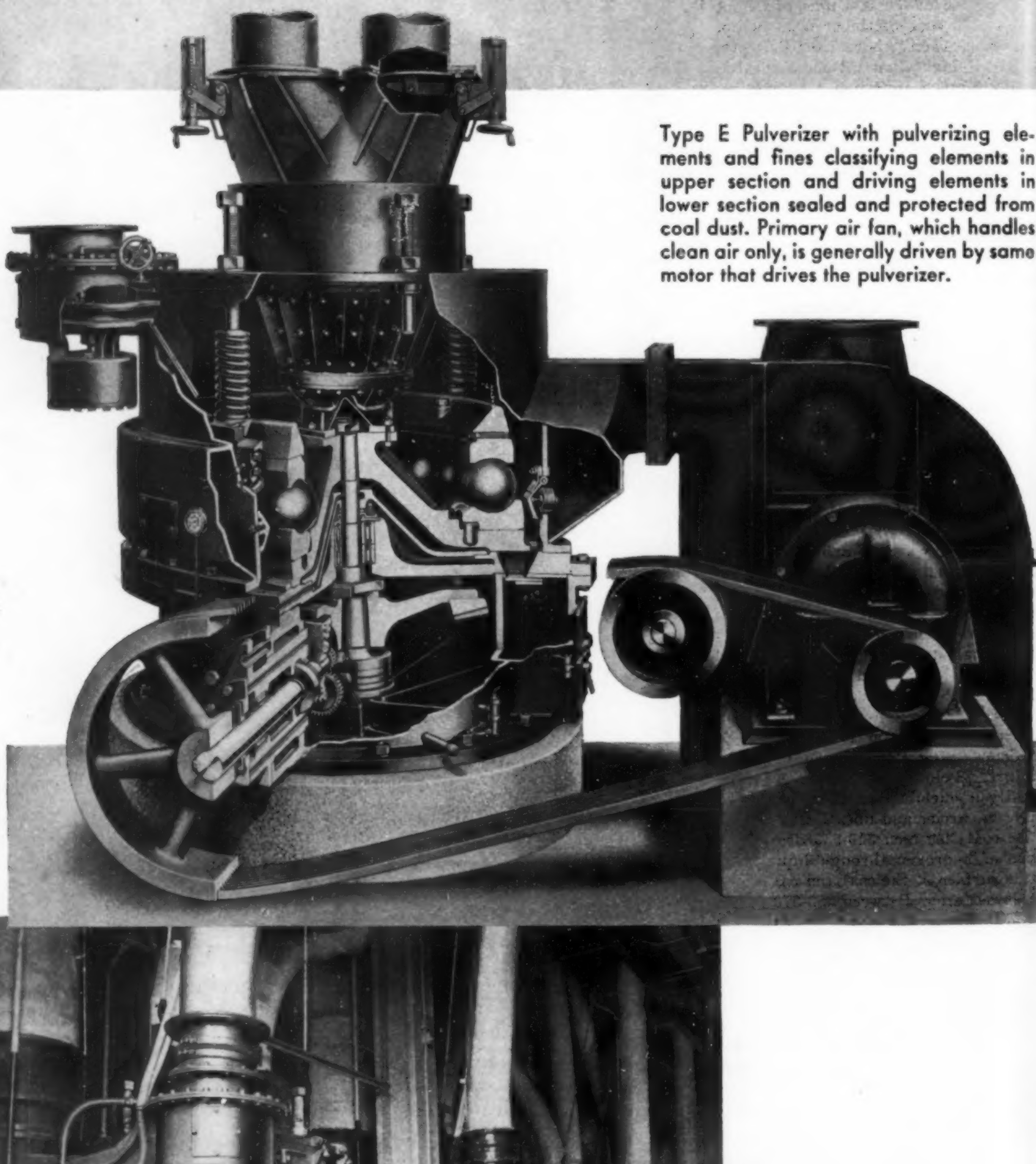
Above 385 deg. C. the rate of primary decomposition of coal surpasses that of secondary decomposition which is probably a reaction between oxygen-containing groups of the primary decomposition products and a reactive hydroaromatic such as tetrahydronaphthalene.

H. H. Storch, C. H. Fisher, C. O. Hawk, and A. Eisner, U. S. Bureau of Mines, before the Division of Gas & Fuel Chemistry of the American Chemical Society, Detroit, Mich., April 12-16, 1943.

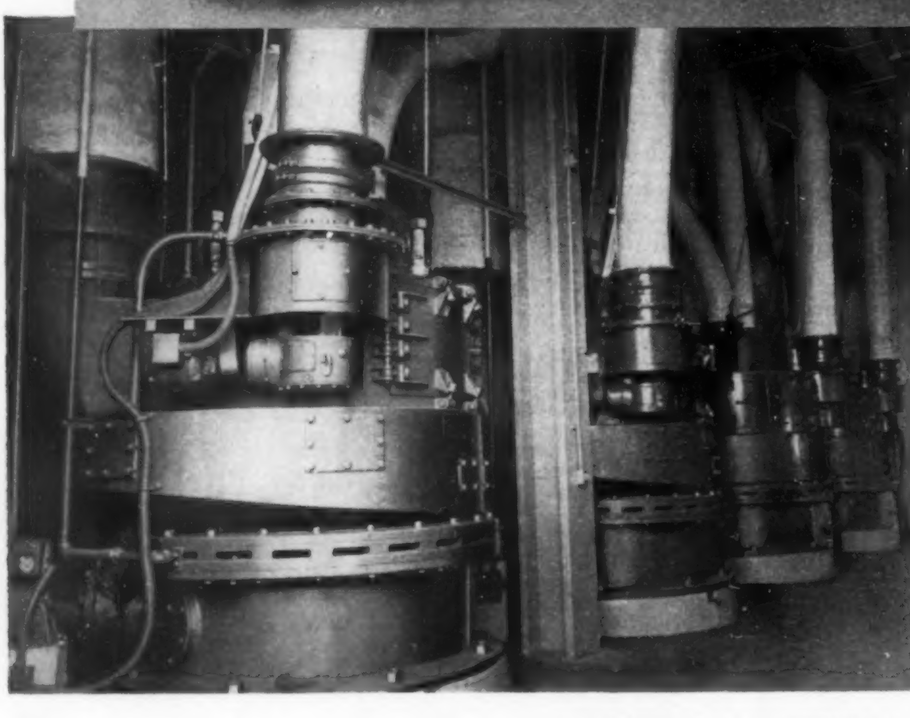
• • •

When the chemical engineer has worked with workmen, and has been selling with salesmen, and discussing finances with financial men and research plans with technical groups, he begins to acquire the necessary habits of thought and an insight into the various types of minds with which he must deal, if he is to function in an administrative capacity.

The B&W



Type E Pulverizer with pulverizing elements and fines classifying elements in upper section and driving elements in lower section sealed and protected from coal dust. Primary air fan, which handles clean air only, is generally driven by same motor that drives the pulverizer.



Over 400 Type E Pulverizers are service or on order for direct firi boilers. Individual installations ha as many as 16 units.

NEWS FROM ABROAD

FUEL ECONOMY AND IMPORT DIFFICULTIES INCREASE BRITISH INTEREST IN SUBSTITUTION PROBLEMS

Special Correspondence

Only now that the government-sponsored fuel economy campaign is in full swing, does it become clear how close are the connections between fuel industry and chemical trades. The government fuel economy program is remarkable for the diversity of methods applied to that end, and chemical manufacturers cooperate with the fuel industry not only as important consumers of coal and coke, but also as suppliers of substitute fuels and as producers of substances which can help to reduce the consumption of coal required for the development of a certain amount of heat. Among substitute fuels a creosote-pitch mixture supplied in substantial quantities by coal-tar distillers is used on quite an important scale in place of imported fuel oils.

The Ministry of Fuel and Power has arranged for the conversion of oil-burning furnace and boiler plant to the burning of this creosote-pitch mixture, and experience so far has been satisfactory, so much so that it seems likely that any surplus which may arise during normal operations after the war will be disposed of in this way, even though imported fuel oils may again become available on a larger scale. Another new fuel which is likely to increase in importance are coal briquettes. There are now 25 coal briquetting machines in action, and by next autumn hundreds of thousands of tons of briquetted coal will be available. Considerable use of briquetting has been made in Continental Europe, especially for lignite, but in the British Isles this is a new development of special importance for the disposal of inferior grades and sizes of coals.

The fuel economy problem in the chemical trades has been tackled through the industrial organizations. These have invited their members to meetings at which opportunities are provided for the exchange of experience and for expert advice on fuel saving practice. In

the plastics industry, to quote an important example, a questionnaire asking for statistics concerning average consumption of gas, electricity, coal, and coke was sent to manufacturers, and the results obtained in this way were circularized in a memorandum to individual firms in which attention was drawn in particular to those points which had been found to be most important from the point of fuel economy. The expert committee in charge came to the conclusion that while the problems attaching to heat and power generation are those confronting all industries, those of utilization deserve to be approached from the special angle of the plastics industry. Reduction of moisture losses by efficient covering on all piping and steam flanges; installation of steam separators at suitable points, with strainers, check valves, and traps; checking-up on leaking joints; lagging of flanges; correct choice of steam traps in accordance with the conditions under which they work—these are some of the points selected for special mention.

Industries which are using very high furnace temperatures—iron and steel, glass, pottery, refractories, cement and lime producers—have also entered upon an exchange of practical knowledge. Some of these industries are able to calculate exactly the quantity of fuel necessary under ideal conditions, which is a great help in assessing economy possibilities. In the cement industry efforts have been made to use a dry mixing process, such as is used in the United States, for drying out the slurry, but so far this has been unsuccessful.

Much attention has been paid to avoiding excessive use of fuel by improving insulation and eliminating waste heat, but these efforts cannot be expected to yield great results in existing plants unless considerable reconstruction work is carried out. There is, however, the possibility of making better use of waste heat and waste gases. The British Refractories Research Association has been working on special refractories for certain boilers and furnaces. At power stations coal has been saved by making increased use of water chlorination, with a view to the prevention of gradual deposition of algae on condenser tubes. Were chlorination plant installed everywhere, an annual saving of something like 600,000 tons of coal annually would be the result, according to one claim.

Rayon Federation

Co-operation between individual firms and exchange of knowledge gained in practical operations is a feature in other fields of British industrial activity. A British Rayon Federation has been formed to include the Rayon Producers' Committee, Rayon Weaving Association, Rayon Warp Knitters, Rayon Staple Spinners' Association, and many other trade organizatinos. A Rayon Council had been set up earlier to assist the Rayon Controller, but lately it was felt that a more closely-knit organization was required to help in the prac-

tical execution of tasks devolving on the industry. At the same time the link existing between silk and rayon producers in the form of the Rayon and Silk Association has been severed. Another new organization is the British Shellac Bleachers' Association whose aim it is to improve, by united effort, the quality and output of British bleached lac, with the ultimate object of participating, after the war in the European export trade (which in the past was in foreign hands) of securing the best possible raw materials from India, and of building up a sound trade based on an agreed policy of buying and selling.

The annual report of the Imperial Institute for 1942 again shows the wide variety of investigations entrusted to this organization and draws attention to the stimulus which new products and new sources of supplies in the colonial territories have received owing to the war. Agar was received from New Zealand and, except in appearance, compared very favorably with the established commercial grades. New Zealand seaweed was investigated and is believed to be of value in place of Irish moss for certain purposes. Po-yok oil extracted from po-yok fruit received from Sierra Leone was found to be generally superior to linseed oil, though inferior to tung oil. Of special interest is an investigation concerning essential oils from the Congo which was carried out for the Comité Special du Katanga. Geranium oil from that source was rather inferior in odor to Algerian and Réunion oils but would compete favorably with Kenya geranium oil. Basil oil was found to have the normal characteristics, although it was inferior to the French oil. Eucalyptus citridora could not in normal circumstances compete with Java citronella oil, even though it commands a lower price. The fourth sample, of unstated botanical origin, was considered to be promising as a flavoring agent and for use in the soap and cosmetic industries. Another investigation was concerned with citronella and lemon-grass oil from the West Indies. These would meet with a ready market in England now, but compared with the Java type citronella oil its post-war prospects appeared less satisfactory. A substitute for gum damar to be incorporated in a special type of paint was found in certain shellac compounds, and a plastic material may also fulfill the requirements.

It is characteristic of the Imperial Institute's work in wartime that many of these investigations had the purpose of helping to establish new sources of production for commodities which used to come from producing countries no longer available to British consumers. Yet the Imperial Institute's work has always been concerned with the dissemination of knowledge about materials produced in some countries to potential producers in others, and in this work there has been no interruption. The production of pyrethrum in India was attempted first in 1937. Since then it has been established that its cultivation

s possible in some parts of the coun-, and if grown above an altitude of proximately 4000 feet the Indian nt seemed quite capable of compet-with that grown in Japan or Kenya. nother development of general in-est is the plan to produce in the East ican territories at least a portion the local quinine requirements. Tan-yika produces cinchona bark which l be made into totaquina in a fac-y recently opened at Dar-es-Salam.

Quinine Substitutes

In the meantime British hospital au-orities have been informed by the nister of Health that synthetic sub-tutes for quinine are available from eral British manufacturers. The ducts in question are mepacrine hy-ochloride B.P., mepacrine Methane-phenate B.P., and pamaquin B.P. A r sulphonamide derivative is being duced by a British firm. The com-und is 2-para-succinylaminobenzene-lphonamido-thiazole. It is stated to rt a potent anti-bacterial effect with-the intestinal tract.

To what extent government agencies e forced into undertaking new tasks shown by a report from Turkey that e United Kingdom Commercial Corp. s begun there to manufacture soap om its local stocks of olive oil. The nited Kingdom Commercial Corp., ays an important part in the prac-al implementation of the Anglo-Turk-commodity transactions. The caustic da required is reported to be supplied the United States, and it is hoped at the increase in Turkish soap pro-ction will result in a general reduc-n of producing costs. An initial con-gnment of 1,500 tons of soap has been ranged for Russia, and some hun-eds of tons are to be distributed by e International Red Cross in Greece.

The supply of the British colonies ith medicinal products is to be under-ken centrally through the medium of e Crown Agents. This is another new velopment capable of considerable ex-nsion after the war and has there-re aroused some concern in the trades ncerned. The National General Ex-rt Merchants' Group has protested to e Colonial Office and Board of Trade ainst the introduction of a scheme r the bulk purchase of essential med-al supplies. No objection is raised the purchase in bulk of supplies that ay have to be made from the United ates or to the decision to estimate the quirements of the Colonies, but so far supplies from Great Britain are con-rned the traders represented see no vantage to be gained from the new stem. The principl involved in these vernment transactions is of consider-le importance, and since the question f export policy after the war has lately ceived some attention, all actions of vernment agencies are subjected to se scrutiny. Nevertheless, it seems rtain in present circumstances that rect government participation in trad-g with Colonies and other overseas untries will, if anything, increase but rtainly not decline in importance.

SODIUM CELLULOSE GLYCOLATE FINDS WIDE APPLICATION AS A SUBSTITUTE MATERIAL IN THE REICH

In a recent issue of Foreign Commerce Weekly, Virginia Kinnard of the Division of Industrial Economy, has an article which states that sodium cellulose glycolate, a gelatin substitute developed in the last war is now finding wide application in the Reich. It is being used in place of scarce, ordinarily imported materials such as gum arabic, agar-agar, caragheen or Irish moss, gum tragacanth, cherry gum, carob gum, and gluten.

The article states that cellulose chemistry research, especially in connection with cellulose for producing fibers, wood sugar, and plywood plastics, has helped to provide a basis for the improved sodium cellulose glycolate now being used to supplant natural products in the manufacture of adhesives, textiles finishing and sizing agents, thickeners, and emulsifiers, even including those employed in the photographic field.

In addition to these industrial applications the recent discovery of the physiological inertness of sodium cellulose glycolate opens up new fields for its use, particularly as a stabilizer in the foodstuffs industry. Through slight variations in the complex molecular structure of this cellulose ether, which is now better understood than it was a decade ago, more than 40 different preparations are now said to be manufactured by six German concerns. Commercial-scale production of them, however, began only around the outbreak of the present war.

The formerly imported natural substances, obtained from seaweed or gummy exudations of certain plants and trees, although not used in large amounts, are indispensable in many specialized manufacturing processes. Generally, their value lies in their mucilaginous nature and their ability to gelatinize even when considerably diluted.

Probably the best-known product in the group is agar-agar, long associated with the Orient, where it is extracted from marine algae or seaweeds, found along the coasts of China and Japan. After boiling the weed, the resulting solution is strained, cooled, cut into blocks, and then pressed into bundles of strips. The finished product is a white, powdery substance. Germany imported 75 tons of agar-agar from Japan in 1938. Little information is available as to whether the new test-tube product is a completely satisfactory substitute for agar-agar in its important uses, as a medium for cultivating bacteria, as a medicinal substance, or as a base and stabilizer. By far the outstanding industrial use of agar-agar is in the form of a base where it is used in the manufacture of about 200 commodities.

Irish moss or caragheen, made of kel

taken from the coasts of Ireland and North America, is used as a demulcent for soothing and protecting inflamed tissues, and as a clarifying agent in brewing. In addition to considerable quantities of Irish moss, Germany imported about 1,500 metric tons of gum arabic, mostly from the Anglo-Egyptian Sudan, and 1,400 tons of gum tragacanth in 1938, the last year for which statistics are available; some gum tragasol was also imported.

Gum arabic, a fine white powder, is obtained by drying the gummy exudation of the acacia verek. The average yearly crop per tree is from 1 to 2 pounds. Gum arabic has many uses, although perhaps its greatest application is in the confectionery trade—it is used to give smoothness and elasticity to candies and icings. In medicine the best-quality gum is employed as a softener or soothing agent, and as an emulsifier. It is also used in sizing, stiffening, and finishing textiles, for calico printing, and in clearing liqueurs. Any number of manufactured items—from shoe polish to matches—also make use of this highly serviceable chemical agent.

Gum tragacanth is the gum of a tree growing in Asia Minor. Its collection and preparation are similar to that of gum arabic, and it has many of the same uses.

Tragasol or carob gum is used in finishing textiles, for tanning, and in the manufacture of face creams and mucilage. With sources of supply for these natural products cut off, Germany began a widespread search for substitutes used in various industries in this war as well as the last one.

Toward the end of World War I when Germany was similarly cut off, a sodium cellulose glycolate, soluble in cold water, was produced through the action of monachloracetic acid on alkali cellulose in alcohol solution, by the Deutsche Celluloid Fabrik, Eilenburg, near Leipzig (German patent No. 332,203). This old firm, now a subsidiary of I. G. Farbenindustrie, is one of the larger producers of raw celluloid for film and nitrocellulose for explosives, and in making sodium cellulose glycolate drew on its long experience with cellulose materials.

In 1924 an improved process was developed by J. K. Chowdhury (described in "Biochemische Zeitschrift" 1924, vol. 148, p. 85), avoiding the use of alcoholic solutions. Production on a commercial scale was delayed, however, by the small margin of profit and by technical difficulties. One of these is that the size of the apparatus required is large in relation to the output of the product (about 50 kilograms per cubic meter) and the process must be carried out in special alloy steel equipment.

Details of the process developed by F. Hoeppler in 1938 and applied on a large scale in the plant of the Gebrueder Haake in Medingen-Dresden, a center of German cosmetic production, are not available, since only parts of the process have been patented and others remain trade secrets. However, it is known that the process is basically similar to that developed by Chowdhury in 1924.

In the earlier laboratory method, about 1,100 grams of 40 percent caustic soda solution are allowed to act on 100 grams of ground-up cellulose for 3 hours at ordinary temperatures. Then 400 grams of monochloracetic acid are added, and the mixture is allowed to stand for 24 hours. The clear viscose solution is then precipitated with 2,000 cubic centimeters of alcohol and extracted for 16 hours with 80 percent alcohol in a Soxhlet apparatus with reflux condenser. Further purification yields about 140 grams of sodium cellulose glycolate with a constant sodium content of about 6.3 percent. The resulting product is a water soluble ether, although it has sometimes erroneously been called a cellulose ester.

For comparative purposes the 40 variations of sodium cellulose glycolate are tested in a Hoeppler viscosimeter, with viscosity of a 2 percent solution at 20° C. in centipoise (the viscosity of water at 20° C. is taken as 1.00) being considered as a standard. Tests of various sodium-glycolate products on the market show viscosities ranging from 10 to 1,000 units centipoise. The viscosities of the non-homogeneous, colloidal solutions depend very largely on the state of degradation of the cellulose used in their preparation.

Whatever commercial value the new series of products has is based on the high viscosity of the solutions and on their power to gelatinize when diluted. Low-viscosity preparations are being used as textile dressing and finishing agents, while the medium- and high-viscosity products are used in making sizing, wallpaper paste, thickening agents, and employed in the preparation of emulsions.

STOCKS OF PALM OIL HELD AT LIBERIAN PORTS

Because of shipping shortages, resulting from war conditions, Liberia has been cut off from the markets for palm oil, normally one of the country's chief crops. In 1941 only a sample shipment of 55 gallons was exported, and in 1942 no palm oil whatever was shipped out. It is reported that 66,850 imperial gallons of palm oil, available for shipment, are stored at the port of Sinoe.

The quality of Liberian palm oil is said to be inferior to that produced in British West African colonies where such commodities are inspected, graded, and controlled. The free fatty-acid content of Liberian palm oil is reported to run from 40 to 55 percent, whereas oil from Nigeria can be exported with a free fatty-acid content of only 5 percent.

FURFURAL PRODUCTION PLANNED FOR DENMARK

Furfural, an oily, colorless substance used as a substitute for wax and as a component in a printing-roller compound, will be manufactured in Denmark by the strawboard industry. The extraction of furfural will yield also several byproducts. A process has been developed, and it is expected that production will start soon.

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IT WOULD have been easy to make it in three sections and assemble it like a tower. But the customer wanted a tank 9 feet high and 30 inches in diameter, all in one piece, of acid-proof chemical stoneware. And that is what Maurice Knight engineers designed and Knight craftsmen made for him.

From a practical standpoint, we criticize ourselves for advertising Knight-Ware of such size, for it requires utmost care in processing and handling. Also, to get such big pieces in their green state into kilns for firing is a delicate job wrought with difficulties. This tank weighed close to a ton.

Such manufacture reflects the Knight experience and ability to make almost any size and type of acid-proof, leak-proof chemical stoneware to the customer's own specifications.

In addition to special pieces, Knight-Ware can be had in standard items such as valves, pipes, fittings, acid jars, kettles, coils, filters and towers. As with all Knight-Ware, the *body itself,* not the glaze or coating, is acid and corrosion-proof.

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CHEMICAL EQUIPMENT

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ABSTRACTS FROM FOREIGN LITERATURE

FILM ON ALUMINUM ALLOYS

ANODIC oxidation is one of the important methods for providing a protective surface to airplane parts made of aluminum alloys. Parts subjected to anodic treatment by the sulphuric acid method followed by treatment with a solution of potassium bichromate have served for more than a year without any further protection and without showing any signs of corrosion. Moreover, this anodic film makes an excellent base for application of lacquers and paints, whereas untreated aluminum has very poor adhesive qualities for that purpose.

Electrolytes used in the anodic oxidation of such aluminum alloys must have a mildly corrosive effect on the oxide film being formed, otherwise the first passive film formed will be so dense that it will prevent the anodic process from proceeding. If they are too corrosive they will destroy the film as rapidly as it is formed. Satisfactory electrolytes are oxalic acid, sulphuric acid, sulphates, alum and permanganates.

The process can be followed by watching the change in weight of the article being treated. Under the experimental conditions in this case the rate of chemical solution of the Al_2O_3 was 0.0023 g. of aluminum per minute from 1 sq.in. which would mean a loss of 4.6 g. of aluminum per sq.m. during a 20-minute operation. This figure corresponds closely to that for large-scale operation, which is 5 g. per sq.m.

Rate of growth of the film decreases considerably with increased thickness of the film. In anodic oxidation with sulphuric acid it was found that as the film grows thicker, an increasingly greater part of the current is expended on evolution of oxygen at the anode. Thickness of the oxide film can be determined on the basis of the amount of electricity utilized.

Digest from "Mechanism of Anodic Oxidation of Aluminum in Sulphuric acid", by G. V. Akimov, N. L. Tomashov, and M. N. Tiukina, *Zhurnal Obshchei Khimii* XII, No. 9–10, 433-448, 1942. (Published in Russia.)

INHIBITORS IN PETROLEUM PRODUCTS

AN UNIQUE method has been developed by the Standard Oil Co. of Brazil for the determination of inhibitors in petroleum products, based on the saponification reaction.

Actual determination is carried out as follows: 20 g. of the inhibited oil are placed in a 250 cc. Erlenmeyer flask, then 20 cc. of petroleum ether and 20 cc. of 0.5N alcoholic solution of KOH are added. Another flask is provided with a control solution of 20 cc. of petroleum ether and 20 cc. of 0.5N alcoholic KOH. Both the sample and the control test are refluxed 3 hr. and then permitted to cool,

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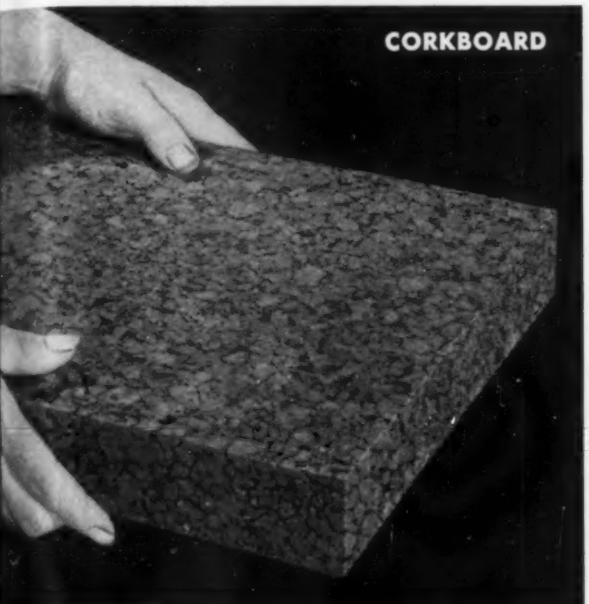

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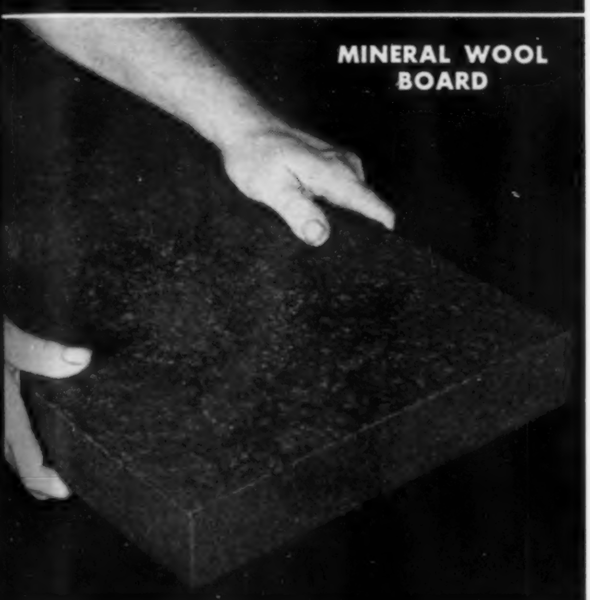
Armstrong's Corkboard is recommended without reservation because of its record of dependability under severe service conditions. Corkboard—long regarded as the standard for low-temperature insulation—is light, strong, rigid, and is highly resistant to moisture and common forms of deterioration.



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This structurally strong board is processed from mineral wool and suitable binders. It is an effective barrier to heat, has good moisture resistance, and is free from objectionable odors. Armstrong's Mineral Wool Board is self-supporting, will not settle, sag, or warp. It is especially recommended where original cost is a factor.

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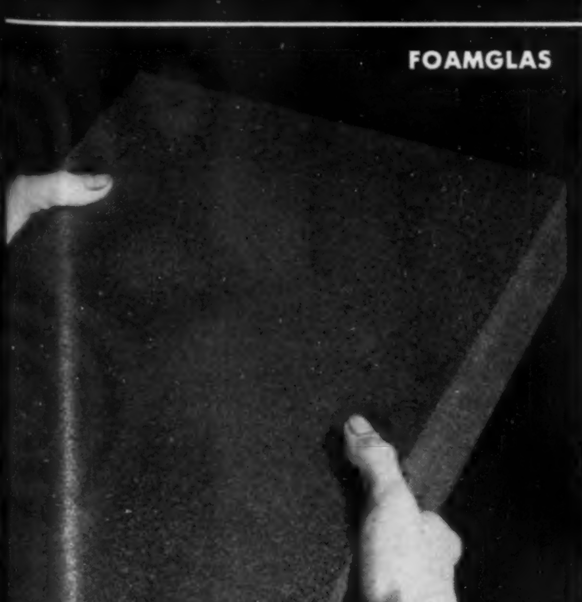

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after which 20 cc. of neutralized alcohol are added and the solution titrated with 0.5N HCl solution, using phenolphthalein as indicator.

If N is cc. of 0.5N HCl used in neutralization of the control, n the cc. of 0.5N HCl used in neutralization of the sample, I^s the index of saponification of the inhibitor, and m the weight of sample, then

$$\text{percent inhibitor} = \frac{(N - n)\ 28 \times 100}{m \times I^s}$$

Digest from "Determination of Inhibitors in Petroleum Products," by C. E. Nabuco de Araujo Junior and Leopoldo A. Miguez de Mello, *Anais da Associacao Quimica do Brasil* I, No. 1, 16-18, 1942. (Published in Brazil.)

COLUMBIUM IN NITRIDING STEEL

PRESENCE of the element columbium in carbon steels causes a considerable increase in the surface hardness of the steel during nitriding and also increases the thickness of the nitrided layer, thus accelerating the process. Only the active or free columbium has this effect, since that portion of the element present as the carbide does not take part in the nitriding process. The quantity of active columbium which does take part in the reaction depends primarily upon the solubility of this metal in iron in the solid form in the presence of other components. An excess of the element is of no benefit.

An attached table gives the Vickers hardness (P=20 kg.) of two nitrided steels: (A) which contains 1 percent aluminum and some columbium and (B) which contains only the 1 percent aluminum and no columbium.

Digest from "Effect of Niobium in Nitriding Steel", by N. M. Voronov, *Zhurnal Prikladnoi Khimii* XV, No. 1-2, 47-50, 1942. (Published in Russia.)

Hardening Effect of Columbium in Nitrided Steels

(Duration of Process, 5 hr.)

Steel Specimen	Process Temperature	Hardness Before Nitriding (Annealed)	Hardness After Nitriding	Percent Increase in Hardness
A	500°	96	250	260
B	300°	78	129	165
A	600°	88	580	660
B	600°	82	312	380
A	650°	90	549	610
B	650°	85	350	422

PETROLEUM PRODUCTION IN MEXICO

TOTAL production of crude petroleum in Mexico from 1901 (when operations first began in that country) through 1941 amounted to some 2,034,103,000 bbl. During the latter part of 1941 there was a considerable increase of activity in oil well drilling in Mexican fields. A total of 22 wells was drilled during that year, 12 of which were productive. These had an initial total capacity of some 29,600 bbl. of crude oil daily.

Some 42,603,300 bbl. of various petroleum products were produced during 1941, 45.6 percent of which was fuel oil, 22.4 percent crude gasoline, 10.1 percent refined gasoline, and 9.7 percent gas oil.

Present outlook for Mexico's petroleum

industry is favorable since the North American market is good under present war conditions. To encourage further activity, the United States is to provide the necessary equipment and machinery for expansion in the Mexican fields.

Digest from "Petroleum Activities in Mexico until December 31, 1941", *Boletin de Minas y Petroleo* XIII, No. 4, 119–121, 1942. (Published in Mexico.)

VINYL PHENYL ETHER

VINYL phenyl ether has been successfully synthesized on a small scale in the following manner: 300 g. of phenol were placed in an autoclave in the presence of 5-20 percent catalyst, which was caustic potash in this case. Acetylene was added from a cylinder at an initial pressure of from 10 to 18 atm. and the process was carried out at a temperature of about 180 deg. C.

When dry phenol was used in the synthesis, the end product was a vitreous, resinous mass. This was undoubtedly the result of side reactions as well as of the tendency of vinyl phenyl ether to thermopolymerize. Several experiments were conducted in which small quantities of water (from 10 to 15 percent) were added to the phenol in the autoclave. The resulting vinyl phenyl ether could be separated out in the pure form with a yield of about 60-80 percent.

Metal chlorides were found in the experiments to be effective catalysts for the polymerization of vinyl phenyl ether. The resulting polymers were colorless, transparent materials.

Digest from "Synthesis and Properties of Aryl-Vinyl Ethers", by M. F. Shostakovski and M. S. Burmistrova. *Zhurnal Prikladnoi Khimii* XV, No. 4, 260–266, 1942. (Published in Russia.)

IRON AND STEEL IN BRAZIL

BRAZIL'S consumption of iron ore for the domestic production of cast iron and steel has increased considerably since 1931. The national production of cast iron in 1941 was seven times as great as that of 1931, and the production of steel was six times as great. Imports of these materials in 1941 were three times as great and the consumption four times as great as compared with 1931.

An accompanying table shows the growth in the Brazilian consumption of cast iron and steel (raw material) in thousands of tons.

Digest from "Cast Iron, Iron and Steel, Analysis of the National Consumption of Raw Material in the Period 1931–41," *Boletim do Conselho Federal de Comercio Exterior* V, No. 31, 1–2, 1942. (Published in Brazil.)

Brazilian Iron and Steel Industry

(Thousands of Tons)

Year	Cast Iron Production	Iron and Steel Exports	Iron and Steel Imports	Iron and Steel Consumption
1931....	28	..	26	54
1932....	29	..	30	59
1933....	47	..	60	107
1934....	59	..	74	133
1935....	64	..	99	163
1936....	78	..	106	185
1937....	98	..	132	230
1938....	122	2	93	213
1939....	160	23	91	227
1940....	186	31	96	251
1941....	209	55	74	227


The Supporting Cast in the
GREATEST PRODUCTION
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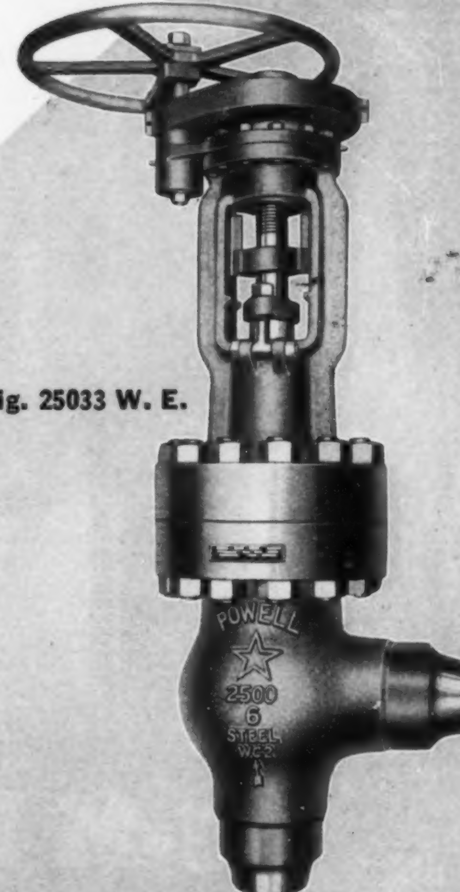

Fig. 25033 W. E.

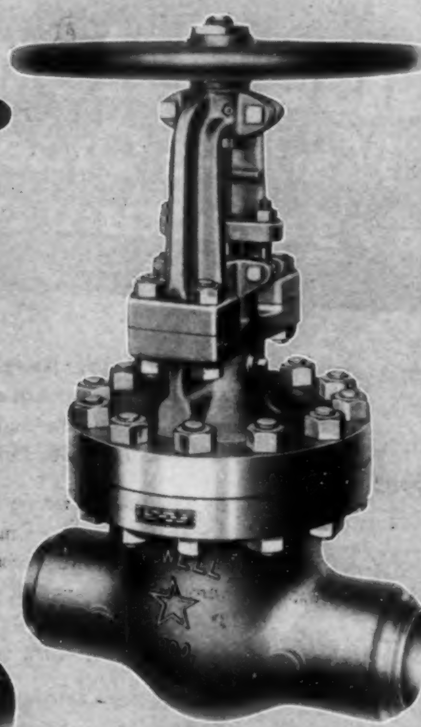

Fig. 9003 W. E.

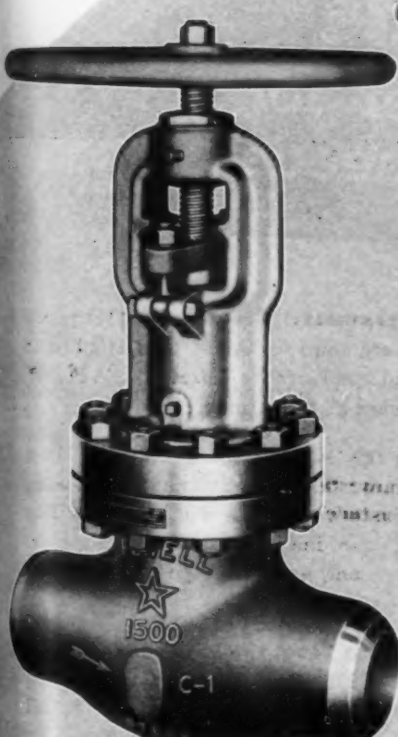

Fig. 1331 W. E.

Fig. 25033 W. E.—Class 2500 pound Cast Steel Angle Valve with welding ends, outside screw rising stem, bolted flanged yoke and spur gears. Can be equipped with bevel gears and motor operator. Regularly furnished with semi-cone seat and disc but for special throttling service can be furnished with piston-guided disc. (Fig. 25028 W. E.)

Fig. 1331 W. E.—Class 1500 pound Cast Steel Globe Valve with welding ends, outside screw rising stem and bolted flanged yoke. Sizes 3" and larger are regularly furnished with Anti-friction bearing yoke and spur gears.

Fig. 9003 W. E.—Class 900 pound Cast Steel Gate Valve with welding ends, outside screw rising stem and bolted flanged yoke. Seat and disc are hard faced with Stellite.

VALVES

CHEMICAL ENGINEER'S BOOKSHELF

AMERICAN POTASH

POTASH IN NORTH AMERICA. By *J. W. Turrentine*. Published by Reinhold Publishing Corp., New York, N. Y. 186 pages. Price $3.50.

In 1926 there appeared the book "Potash: A Review, Estimate and Forecast" by the above author. The primary purpose of the present volume is to review the developments, both economic and technological, that have taken place in the domestic potash industry since those dark days of the middle twenties, when only a handful of government and industry optimists, including the author, prevented this country from settling back into comfortable and complete dependence upon German imports for potash supplies. No one is better fitted to chronicle the remarkable developments of the American potash industry than Turrentine, who is now president of the American Potash Institute and for many years was in charge of Potash Investigations of the U. S. Department of Agriculture.

First, the author devotes considerable space to outlining potash developments during the past 16 years, both domestic and foreign. Major legislative and cartel actions relating to this chemical raw material are included in this section. Next some 55 pages deal with the uses of potash in American agriculture and industry. This section includes considerable statistical data, with figures on imports and exports in table and chart forms. The final chapter of 75 pages deals with the technology of potash production in this country, including that at Searles Lake, the great Permian Basin deposits, and the recently exploited Salduro Marsh brines. Most of the material in this technology section is quoted directly from recent articles which have appeared in the technical literature.

Turrentine has turned out an excellent summary of the developments of the domestic potash situation since 1926, and this volume will undoubtedly be welcomed by all persons interested in this great and independent American industry.

COAL AND COKE

COKE FORMATION PROCESS AND THE PHYSICO-CHEMICAL PROPERTIES OF COALS. By *W. Swietoslawski*. Published by Polish Institute of Arts and Sciences in America, New York, N. Y. 145 pages. Price $3.50.

Reviewed by *F. C. Nachod*

It is gratifying to note that wars also bring about good developments. Dr. Swietoslawski, formerly of the Institute of Technology of Warsaw, published this book originally in Polish. As an exile from his native Poland, he came to this country and subsequently his work was published in English, thus making available to the Anglo-Saxon audience a large amount of data and experiments which otherwise would probably not have been accessible.

The present booklet does not pretend to be a comprehensive treatise on the subject. The author is aware that an American Chemical Society monograph is in preparation which will cover the subject and the pertaining literature completely. The scope of the book may be understood by an examination of the chapter headings:

Coals as in homogeneous systems, Adsorption and Sorption Phenomena in Coals, Development of Surface by Activation Processes, Ignition Temperature of Solid Fuels, Plasticity of Bituminous Coals, Plasticity Phenomena and Binding Capacity of Coals, Agglutination Capacity of Coals, Swelling Phenomena in Coking Coals, Binary Mixture Method, Permeability of the Plastic Zone, Heat of Carbonization of Coals, Total Amount of Gases and Vapors developed during Carbonization, Physico-Chemical Analyses of the Coke Formation Process, Coke Formation Process in Mixtures of Non-Coking Coals and Pitch, Optimal Conditions for the Coke Formation Process.

The booklet is recommended to the chemist and the chemical engineer working in this field.

GAS PROCEEDINGS

PROCEEDINGS OF THE AMERICAN GAS ASSOCIATION, 1942. Published by American Gas Association, New York, N. Y. 441 pages. Price $3 to members, $7 to non members.

This is the usual printing of all the technical articles and committee proceedings for meetings during the calendar year 1942. It represents a must item in any library which pretends to keep in touch with either natural gas or manufactured gas literature.

SMALL PARTICLES

MICROMERITICS. By *J. M. Dallavalle*. Published by Pitman Publishing Corp. New York, N. Y. 428 pages. Price $8.50.

Reviewed by *Lincoln T. Work*

This title, derived from the Greek from "small" and "part" is used to cover the technology of fine particles. The author has introduced the work by discussing the order of magnitude of particle size measurement which this covers, namely, the range from 10^{-1} to 10^{4} microns, discussing the application to soil physics; mineral physics; chemical engineering; geology—ground water and petroleum; hydrology—silting of streams; and other applications. He considers extensively the dynamics of small particles and their shape and size distribution. Under "Methods of Particle Size Measurement" he includes the direct methods of sieve and microscopic measurement and those indirect methods which are based on settling characteristics of the particles. He discusses the theory of sieving and grading of materials with an up-to-date discussion of calibration of sieves. He deals at some length with the arrangement of particles in space, from the packing of spheres to the handling of heterogeneous systems and the flow through beds of packed solids.

Electrical and optical properties, sonic flocculation, thermo-dynamics, including adsorption and chemical properties are also presented. Three chapters are devoted to the flow of fluids through packing, infiltration and particle-moisture relationships, and capillarity. Another chapter dicusses the determination of particle surface, utilizing statistical and experimental methods, and permeability, adsorption and optical methods. Two chapters are devoted to muds and slurries and the transport of particles. Chapters on grinding, air separation, and atmospheric and industrial dust complete the treatment. The author appends an extensive selected bibliography covering early work to the present time.

General treatment of the subject is comprehensive, the material is covered mathematically and many different approaches to the several phases of this subject are reviewed. The author has undertaken some critical commentary but in many cases the work reviewed is not integrated. As a text or reference work in the field, this book gives a good statement of the fundamental principles and practical operation of a wide variety of subjects in which this range of particle size is important. It should be useful as a text for the student and as a handbook for the specialist in this field.

EXPOSITION OF FUNDAMENTALS

AIR CONDITIONING ANALYSIS. By *William Goodman*. Published by The Macmillan Co., New York, N. Y. 455 pages, plus seven psychrometric charts. Price $6.

Reviewed by *T. R. Olive*

Since the appearance in 1938 of Mr. Goodman's earlier book, the Trane Air Conditioning Manual, published by the Trane Co., several excellent books have appeared on air conditioning, but in the reviewer's opinion, the Trane Manual in some ways is still the best work on the subject. The author's new book is a better exposition of the fundamentals, although there could be little complaint on this score with the earlier book, for Mr. Goodman is and was one of the most effective teachers in the entire air conditioning field. He continues to lean heavily on the graphical approach to air conditioning analysis and has now de-

veloped what is evidently a more perfect psychrometric chart than the one used formerly. This has been accomplished, however, with what seems to the reviewer a sacrifice in the convenience of the chart. Possibly more extensive experience with the new chart, a modified Mollier diagram similar to that advocated a number of years ago by Weisselberg, would prove that this is not the case.

A tremendous number of illustrative examples in the new book will assure the reader's thorough understanding of the subject, both mathematical and graphical. In addition, the new volume contains the most complete collection of air conditioning tables to be found anywhere, occupying about half the book and covering all atmospheric pressures from 22 to 32 in. Hg, as well as normal barometric tables in 0.1 deg. F. intervals. The book is novel in devoting little space to the descriptive details of air conditioning equipment.

RECENT BOOKS and PAMPHLETS

The Foreman, the Key Man in Your Plant. Issued by the National Association of Manufacturers, 14 West 49th St., New York, N. Y. 16 pages. Gratis. Principles and practice recommended in the manual are presented in two sections: (1) A sound program for the training and education of foremen; (2) sound principles of management, supervisory relations. Issued so that company practices may be checked against sound policies of American industry.

Manual of Industrial Hygiene and Medical Service in War Industries. Edited by *W. M. Gasaser*. Published by W. B. Saunders Co., West Washington Square, Philadelphia, Pa. 508 pages. $3. Written to meet changed health conditions in industries converted to war purposes and planned specifically for the general medical profession, and others engaged in industrial service. Provides guidance in dealing with industrial health hazards.

A Contribution to the Manpower Problem. By *Albert Ramond*. Published by The Bedaux Co., New York, N. Y. 11 pages. A recently-delivered address which elaborates the view that properly established incentive wage payment is one of the most effective solutions to our present manpower problem.

Tenth Annual Report. Published by Engineers' Council for Professional Development, New York, N. Y. 47 pages. Price 25 cents. Reference material on what engineers are doing in selecting and training new personnel for the profession and in elevating the status of engineers.

Nitriding Furnaces. By *D. Landau*. Published by the Nitralloy Corp., New York, N. Y. 99 pages. In four parts: nitriding and nitriding furnaces, ammonia and its handling, determination of furnace size for nitriding, and instrumentation.

A.S.T.M. Standards on Copper and Copper Alloys. Published by American Society for Testing Materials, Philadelphia, Pa. 376 pages. Price $2.25. Provides specifications widely used throughout industry and by the Government in connection with the war effort. Important features in the new publication are the emergency alternate specifications to aid in expediting procurement.

Battle Stations for All. Published by Office of War Information, Washington, D. C. 128 pages. Handbook on the fight to control living costs and prevent inflation.

The Carbon Reinforcement of Buna S (GR-S). Published by Columbian Carbon Co., New York, N. Y. 152 pages. Researches on the reinforcement of Buna S rubber with colloidal carbon.

Review of Iron and Steel Literature for 1942. By *E. H. McClelland*. Published by

Carnegie Library of Pittsburgh, Pittsburgh, Pa. 25 pages. A classified list.

More Manpower Through Reduction of Absences. Published by Industrial Hygiene Foundation, Pittsburgh, Pa. 63 pages. Six amplified discussions of the different phases of absenteeism presented at the Foundation's last annual meeting.

Road Tests of Automobiles Using Alcohol-Gasoline Fuels. By *R. G. Paustian.* Bulletin 158, Iowa Engineering Experiment Station, Iowa State College, Ames, Iowa. 56 pages. Results of a series of road and laboratory tests designed to measure mileage and performance characteristics of alcohol-gasoline blends.

Women at Work in Wartime. By *Katherine Glover.* Pamphlet 77, published by Public Affairs Committee, New York, N. Y. 31 pages. Price 10 cents. Problems of recruiting women for war jobs.

Literature on the Extraction of Alumina from Clay with Short Discussions. By *R. J. Woody.* Bulletin E-1, Mining Experiment Station, State College of Washington, Pullman, Wash. 31 pages. Price 25 cents. Contains 544 references.

Ninth Biennial Report of the State Water Commission. Public Document No. 78, published by the State of Connectic[ut], Hartford, Conn. 77 pages. Sewage, i[n]dustrial wastes, flood control, strea[m] gaging, etc. Also contains a research r[e]port on treatment of metallurgical waste[s].

Lye Peeling. By *C. F. Wolters, H. G. Elledge* and *R. D. Kerwin.* P[ub]lished by Diamond Alkali Co., Pittsbu[rgh], Pa. 34 pages. Illustrated booklet on peeling of potatoes for dehydration.

A Preliminary Report on Cobalt De[]posits in the Blackbird District, Lem[hi] County, Idaho. By *Alfred L. Anders[on].* Pamphlet 61, published by University [of] Idaho, Moscow, Idaho. 34 pages. Price [] cents. A preliminary report making avai[l]able the data obtained during a reco[n]naisance study of the deposits carried [o]between July 7 and July 14, 1942.

Influence Charts for Computation [of] Stresses in Elastic Foundations. B[y] *M. M. Newmark.* Bulletin Series No. 3[] published by the University of Illino[is], Urbana, Ill. 25 pages. Price 35 cent[s]. Describes graphical procedure for com[]puting stresses in the interior of an elasti[c] homogeneous, isotropic solids bounded b[y] a plane surface and loaded by distribute[d] vertical loads at the surface.

GOVERNMENT PUBLICATIONS

The following recently issued documents are available at prices indicated from Superintendent of Documents, Government Printing Office, Washington, D. C. In ordering publications noted in this list always give complete title and the issuing office. Remittances should be made by postal money order, express order, coupons, or check. Do not send postage stamps. All publications are in paper cover unless otherwise specified. When no price is indicated, pamphlet is free and should be ordered from Bureau responsible for its issue.

First Aid in the Prevention and Treatment of Chemical Casualties. Office of Civilian Defense, OCD 2202-1. Price 10 cents.

Markets After the War. An Approach to Their Analysis. By S. Morris Livingston. Bureau of Foreign and Domestic Commerce, unnumbered document. Mimeographed.

Official Publications of Present-Day Germany. Government, Corporate Organizations and National Socialist Part[y] With an Outline of the Governmenta[l] Structure of Germany. By Otto Ne[u]burger. Library of Congress, unnumbere[d] document. Price 20 cents.

Producers' Sales of Natural Sodiu[m] Sulfates and Carbonates Increased i[n] 1942. Bureau of Mines. Mineral Mark[et] Report, MMS No. 1046. Mimeographe[d].

Manual for Inspection of Damag[ed] Shipments. Prepared by Container C[]

ordinating Committee with cooperation of Army, Navy, and others. March, 1943. Order from War Department.

Some Standard Thermal Dehydration Curves of Minerals, by P. G. Nutting. U. S. Geological Survey Professional Paper 197-E. Price 5 cents.

Monazite Sand, by L. G. Houk. Bureau of Mines, Information Circular I. C. 7233. Mimeographed.

Marketing Kyanite and Allied Minerals, by Nan C. Jensen. Bureau of Mines, Information Circular, I. C. 7234. Mimeographed.

Determination of the Oxides of Nitrogen by the Phenoldisulfonic Acid Method, by R. L. Beatty, and others. Bureau of Mines, Report of Investigations R. I. 3687. Mimeographed.

The Asbestos Industry in 1942. Bureau of Mines. Mineral Market Report, MMS. No. 1047. Mimeographed.

Aluminum Salts and Alumina in 1942. Bureau of Mines. Mineral Market Report, MMS. No. 1048. Mimeographed.

Boron-Mineral Production in the United States Declined in 1942. Bureau of Mines, Mineral Market Report, MMS. No. 1051. Mimeographed.

Potash Industry of the United States in 1942. Bureau of Mines, Mineral Market Report, MMS. No. 1052. Mimeographed.

Production of Coke and Byproducts from Coal Gas Retorts in 1942. Bureau of Mines, Mineral Market Report, MMS. No. 1057. Mimeographed.

Carbon Black Sales Decline 30 Percent in 1942. Bureau of Mines, Mineral Market Report, MMS. No. 1058. Mimeographed.

Mine Production of Copper in the United States, 1942. Preliminary Annual Figures. Bureau of Mines, Mineral Market Report, MMS. No. 1059. Mimeographed.

Mine Production of Lead and Zinc in the United States, 1942. Preliminary Annual Figures. Bureau of Mines, Mineral Market Reports MMS. No. 1060. Mimeographed.

Hard and Soft Kaolins of Georgia. By T. A. Klinefelter, and others. Bureau of Mines, Report of Investigations, R. I. 3682. Mimeographed.

The Burning Rate of Natural Graphite, by Glen Dale Coe. Bureau of Mines, Report of Investigations, R. I. 3692. Mimeographed.

Some Refractory Properties of Washington Chromite. By Hewitt Wilson and others. Bureau of Mines, Report of Investigations, R. I. 3694. Mimeographed.

List of Respiratory Protective Devices Approved by the Bureau of Mines. By H. H. Schrenk. Bureau of Mines, Information Circular, I. C. 7237. Mimeographed.

Olivine. By G. Richards Gwinn. Bureau of Mines, Information Circular, I. C. 7239. Mimeographed.

Coke-Oven Accidents in the United States. By W. W. Adams and V. E. Wrenn. Bureau of Mines, Technical Paper 651. Price 10 cents.

Mineral Wool: Loose, Granulated, or Felted Form, in Low-Temperature Installations. Bureau of Standards, Commercial Standard CS105-43. Price 5 cents.

Union Agreement Provisions. Bureau of Labor Statistics. Bulletin No. 686. Price 35 cents.

Census of Business, 1939. Volume 2. 16th Census of United States, 1940. Bureau of the Census. Wholesale trade. Price $2.75. Clothbound.

Federal Specifications. New or revised specifications which make up Federal Standard Stock Catalog on the following items: Insulation, laminated-asbestos, HH-I-561, price 5 cents. Leather, hydraulic-packing, vegetable-tanned, KK-L-181a, price 5 cents. Tableware, plastic, L-T-48, price 5 cents. Paint, oil, interior, one-coat-flat, heavy-bodied (for thinning), light tints and white (combined sealer, primer, and finish), TT-P-47, price 5 cents. Soap, low-titer (for low-temperature washing), P-S-600, price 5 cents. Acid, hydrochloric (muriatic), technical-grade, O-A-86, price 5 cents.

Federal Specifications Index. Revised to February 1, 1943. Procurement Division, Treasury Department, Federal Standard Stock Catalog. List of specifications which the government uses in its purchasing. Purchase from Superintendent of Documents. Price 15 cents.

MANUFACTURERS' LATEST PUBLICATIONS

Publications listed here are available from the manufacturers themselves, without cost unless a price is specifically mentioned. To limit the circulation of their literature to responsible engineers, production men and industrial executives, manufacturers usually specify that requests be made on business letterhead.

Protective Coatings. Protective Coatings, Inc., P. O. Box 56, Strathmoor Station, Detroit, Mich.—26-page folder dealing with the "Tocol" line of corrosion protective materials put out by this concern. Contains technical information on applications and advantages of "Synthetex", "Silco", and "Alkacite".

Chlorinated Paraffin. Hercules Powder Co., Wilmington, Del.—Form 50014-A—8-page folder dealing with this concern's chlorinated paraffin, first produced to pinch-hit for Parlon in fireproofing formulations. Lists physical and chemical properties, compatability, use as a non-flammable plasticizer and suggests other industrial uses.

Safety Equipment. Mine Safety Appliances Co., Pittsburgh, Pa.—Bulletin 433—32-page booklet entitled "How to Make Your Safety Equipment Last Longer." Discusses and illustrates timely hints on conservation of various safety equipment, such as protective hats, respirators, goggles, safety clothing and first-aid kits. Well organized and full of helpful information.

Apprentice Training. The B. F. Goodrich Co., Akron, Ohio—26-page catalog dealing with the apprentice training program of this company. Deals with such subjects as selection of apprentices, administration of program, length of apprenticeship, shopwork schedules, classroom curriculum, wages, vacations, etc.

Spring Design. Midwest Spring Mfg. Co., 4632 So. Western Ave., Chicago, Ill.—39-page form entitled "Spring Design and Engineering." Discusses basic factors in spring design, compression springs and other forms, wire forms, etc. Contains a table of deflection formulas for helical springs, as well as tables of data on wire. Contains extensive engineering data.

Heat Treatment. Metallizing Company of America, 1330 West Congress St., Chicago, Ill.—4-page form which describes this concern's new electric bonder for preparing hardened metal surfaces for metallizing. Gives operating features, advantages, method of operation and other data. Illustrated.

Pipe Alignment. American District Steam Co., North Tonawanda, N. Y.—Bulletin 3570D—6-page folder covering this concern's improved pipe alignment guide. Includes data on dimension setups, list prices and weights, and recommended spacing for the various types of pipe supports, saddle plates, etc.

Water Treatment. Cochrane Corporation, 17th and Allegheny Ave., Philadelphia, Pa.—4-page reprint on "Operation of Hot Process Softener at 50-lb. Gage Improves Performance and Saves Chemicals." Illustrated by diagrammatic drawings and photographic reproductions.

Vibration Fatigue. All American Tool & Mfg. Co., 1014 Fullerton Ave., Chicago, Ill.—8-page notebook dealing with this concern's line of vibration fatigue testing machines. Discusses principles of vibration fatigue testing, includes a nomograph for vibrating systems and illustrates, discusses and gives specifications for each of the various models of machines.

Insulation. The Sterling Varnish Co., 116 Ohio River Boulevard, Haysville, Pa.

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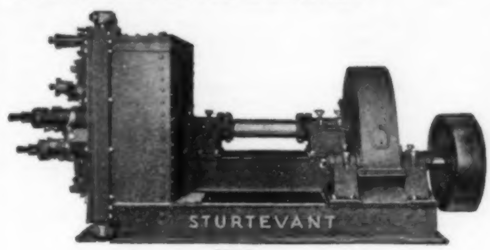

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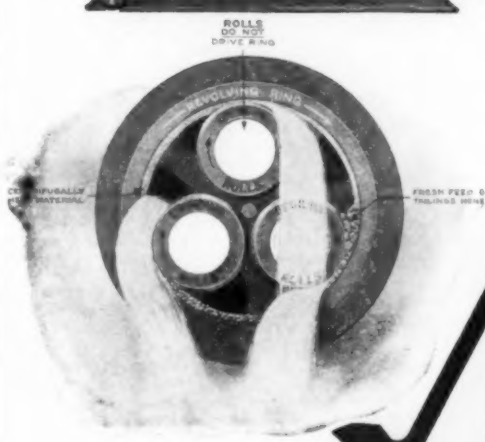

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The output, on suitable material is from 4 mesh to 200 mesh. Screens are usually used in place of Air Separators on products ranging from 4 mesh to 50 mesh. Air Separators from 50 mesh to 200 mesh. The feed may be from 1/8" to 1½". The capacities, according to size of mill and fineness of product, are from 1 ton to 25 tons per hour.

We would like to tell you more about it if you will tell us what your material is, the fineness wanted in the product and the capacity desired.

STURTEVANT MILL COMPANY
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—4-page bulletin describing ten insulating mediums called "Thermobonds" put out by this concern for heavy duty motors and transformers, high cycle drill and grinder motors, etc. Describes outstanding features of these insulating varnishes, their application in various industries, and specifications.

Heat Treatment. Ajax Electric Co., Inc., Frankford Ave. at Delaware Ave., Philadelphia, Pa.—Catalog 107A—20-page booklet entitled "Heat Treatment in Ajax-Hultgren Electric Salt Bath Furnaces." Shows installation of the immersed electrode salt bath furnaces for heat treating processes including hardening high speed steel tools, carburizing, solution heat treatment of aluminum alloys, etc. Discusses operating principles, standard sizes, accessories and mechanical and manual types in general use. Extensively illustrated.

Condensation Prevention. J. W. Mortell Co., Kankakee, Ill.—Form B11—6 pages dealing with this concern's line of plastic cork coatings for stopping dripping from condensation or sweating pipe, tanks, etc. Includes data about properties and applications. Extensively illustrated.

Control Instruments. Wheelco Instrument Co., Harrison and Peoria Sts., Chicago, Ill.—Bulletin Z-6200—16-page bulletin which gives current prices and short descriptions of all instruments for measuring and control put out by this concern. Illustrated.

Vacuum Pumps. American Automatic Typewriter Co., 614 No. Carpenter St., Chicago, Ill.—Bulletin 10—4-page bulletin describing this concern's new bellows-type vacuum pumps designed for production and laboratory applications. Describes construction features and gives tables of specifications for each model. Illustrated.

Farm Raw Materials. South Carolina State Planning Board, 100 Calhoun State Office Building, Columbia, S. C.—Bulletin 12—56-page catalog entitled "From Farm to Factory," a special study on processing and utilization of the state's farm products. Includes extensive data on various methods of food preservation, crops now under cultivation, new crops such as tung trees and tung oil, castor beans, perilla, etc., and summary of farm data by counties. Includes detailed statistical information.

Liquid Gas. American Liquid Gas Corp., 1109 So. Santa Fe Ave., Los Angeles, Calif.—20-page illustrated booklet which discusses briefly uses of "Algas" for domestic and industrial purposes. Discusses origin and qualities as well as uses of liquefied petroleum gases. Extensively illustrated by photographic reproductions and diagrammatic sketches.

Steam Traps. The Strong, Carlisle & Hammond Co., 1392 West Third St., Cleveland, Ohio—Catalog 66—23-page catalog dealing with this concern's steam traps and drainage equipment of various types. Each unit is illustrated by photographic reproductions and cross-sectional drawings and is accompanied by a table of dimensions and list prices.

Time Delay Relays. The R. W. Cramer Co., Inc., Centerbrook, Conn.—Bulletin 800—4-page form illustrating and discussing briefly this concern's line of synchronous motor-driven time delay relays. Contains a table of time scales and price lists, together with wiring diagrams and housing dimensions.

Blowers. L. J. Wing Mfg. Co., 154 West 14th St., New York, N. Y.—Bulletin CO5—8-page bulletin on the line of axial flow blowers with built-in volume control put out by this concern. Each unit is illustrated and discussed briefly. Contains numerous installation photographs.

Koroseal Lined Tanks. The B. F. Goodrich Co., Akron, Ohio—Section 9028—4-page section dealing with Koroseal lined tanks, their resistance to corrosion, applications, advantages and limitations. Includes detailed tables of chemical resistance of Koroseal lining and typical installations of tanks already in service. Illustrated.

Pipe Line Filters. American Locomotive Co., Alco Products Division, 30 Church St., New York, N. Y.—Bulletin 1033—8-page booklet describing and illustrating the pipe line filters put out by this concern. Discusses outstanding features and applications. Illustrated by photographic reproductions and cross sectional drawings.

Pumps. Roots-Connersville Blower Corp., Connersville, Ind.—Bulletin 31B15—6-page folder describing and illustrating the line of positive displacement gas pumps put out by this concern. Includes a table of depth capacities in the low-pressure, medium-pressure and high-pressure ranges. Illustrated by photographic reproductions and diagrammatic sketches.

Synthetic Rubber. The B. F. Goodrich Co., Akron, Ohio—Section 8000—8-page form dealing with the properties of this concern's Americol D synthetic rubber. Gives extensive data on chemical and physical properties, property relations of natural and synthetic rubbers, properties of typical Americol D vulcanized compounds and an application guide table.

Synthetic Rubber. The United States Rubber Co., 1230 Sixth Ave., New York, N. Y.—Form 431—40-page booklet giving information on the five commercial types of synthetic rubber. Includes a historical introduction, a chart of comparative properties of the synthetic rubbers and natural rubber, and brief descriptive material on outstanding advantages and uses of the various synthetic rubbers. Includes condensed information on methods of manufacture, polymerization reactions, vulcanization, and a glossary of terms. Well illustrated.

Lathes. South Bend Lathe Works, 425 East Madison St., South Bend, Ind.—Catalog 100-C—48-page catalog describing the entire line of lathes of various types put out by this concern. Each size and type is illustrated and fully described. Specifications are tabulated to facilitate selection. Attachments and accessories are illustrated and described.

Fluid Filters. The Cuno Engineering Corp., Meriden, Conn.—Form 1343—32-page booklet entitled "Quick Facts on Keeping Fluids Clean." Contains factual information on this concern's line of filters and filter installations in eleven major industrial classifications. Contains 46 actual case studies. Contains tables of specifications. Extensively illustrated by photographic reproductions, diagrammatic drawings and cross sectional sketches.

Tubing. Summerill Tubing Co., Bridgeport, Pa.—Bulletin 443—12-page booklet dealing with the line of tubing and tubing material put out by this concern. Includes a guide chart giving detailed information on chemical composition of 25 different metals in regular production, size and ranges available for each, and mechanical and physical properties of interest in design and use of materials.

Flashlight Batteries. Ideal Commutator Dresser Co., Sycamore, Ill.—4-page form illustrating and describing briefly this concern's rechargeable flashlight batteries for industrial and utility service. Includes brief description of outstanding features and applications.

Control Instruments. Republic Flow Meters Co., 2240 Diversey Parkway, Chicago, Ill.—Bulletin 434—8-page folder illustrating and describing this concern's pneumatic flow transmitter of the differential pressure type for measurement of flow and level. Discusses operating principles, design features, performance, operating adaptability, construction details and specifications. Illustrated by photographic reproductions and cross sectional views.

Pulley Lagging. Victor Balata & Textile Belting Co., 53 Park Place, New York, N. Y.—Circular 13—2-page form illustrating and describing briefly this concern's "Grip-On" safety pulley lagging for straight or crown face pulleys. Describes briefly outstanding principles and applications. Includes a price list.

Graphite Lubricant. Acheson Colloids Corp., Port Huron, Mich.—Bulletin 423—4-page folder illustrating the use of this concern's "dag" colloidal graphite as a high-temperature lubricant. Discusses limitations of liquid or semi-liquid lubricants, and gives case study information on the use of colloidal graphite for various uses. Illustrated.

Vitamins. Vitamins Industrial, 222 N. Bank Drive, Chicago, Ill.—12-page folder dealing with this concern's line of "Vi6" complete vitamins for use in industry. Discusses plans of distribution to industrial workers, mineral and vitamin content of the product as related to daily human needs, and applications in various war industries. Discusses potencies, balance, assimilability, stability, and price.

ECONOMICS AND MARKETS

CONSUMPTION OF CHEMICALS PROMISES TO MAKE SLIGHT GAIN IN SECOND QUARTER

The large industrial chemical-consuming industries have varied their manufacturing rates but little in the second quarter of this year but from present indications will show a slight gain over the results of the first quarter. This is due to some improvement at pulp and paper mills, increased operations at oil refineries, continuance of record outputs of glass containers, larger production at steel mills, and moderate gains in rayon supplies. Production of plastics have gained with particular influences affecting the different types. Consumption of chemicals in direct war industries likewise has felt the effects of different influences. Operations at some of the high explosives plants has been slowed because supplies of finished products accumulated more quickly than had been expected, this in part, due to a higher-than-anticipated efficiency at the plants. Production of aluminum has been cut at a plant using sea water as a raw material and has been increased by the opening of a new producing plant on the Pacific Coast. Plants for making synthetic rubber are now coming into operation and will account for a steadily growing disappearance of chemicals.

The *Chem. & Met.* index for consumption of chemicals for April is 174.49 which compares with 171.38 for April last year. The index for March has been revised to 178.96 which tops the 176.38 reported for March 1942. Some industries have felt the shortage in trained manpower and this promises to be more of a factor before the end of the year. Otherwise the outlook for industrial consumption of chemicals appears favorable for a continuance of the current levels unless necessity for plant repairs becomes a factor.

Demand for carbon black has been more active and consumption is expected to increase materially from now on as synthetic rubber requirements gain in volume. Production of black last year fell off only about 3 percent while sales were off about 30 percent, hence stocks accumulated to a near record degree and continued to grow in the first quarter of this year. Last year, the rubber industry consumed, or at least purchased, almost 296,000,000 lb. of carbon black and undoubtedly will call for deliveries at a much higher rate over the last half of this year. Last year production of furnace black was approximately 24 percent of the output. This year demand for furnace type is increasing and production has been arranged to turn out sufficient of this type to take care of all domestic and foreign requirements.

Current data for superphosphate production are not on the same basis as those formerly issued as the monthly reports now include all units, including government-owned, known to have facilities for superphosphate manufacture. Formerly the monthly figures covered about 95 percent of the producing industry and did not include the TVA output. Production, however, has been running ahead of that of last year and must continue on a large scale as about 6,500,000 tons of normal superphosphate will have to be produced during the 1943-1944 year to round out the fertilizer program. This includes 5,000,000 tons for distribution through commercial channels and 1,500,000 tons through the AAA program. To obtain this total, a tentative quota has been set up for each producer. This means that a fairly regular rate of production will be maintained throughout the year with the usual seasonal fluctuations eliminated. Incidentally the quotas established are not intended to put a limit on total, or individual plant, production but rather to fix minimum levels for each plant.

***Chem. & Met.* Index for Industrial Consumption of Chemicals**

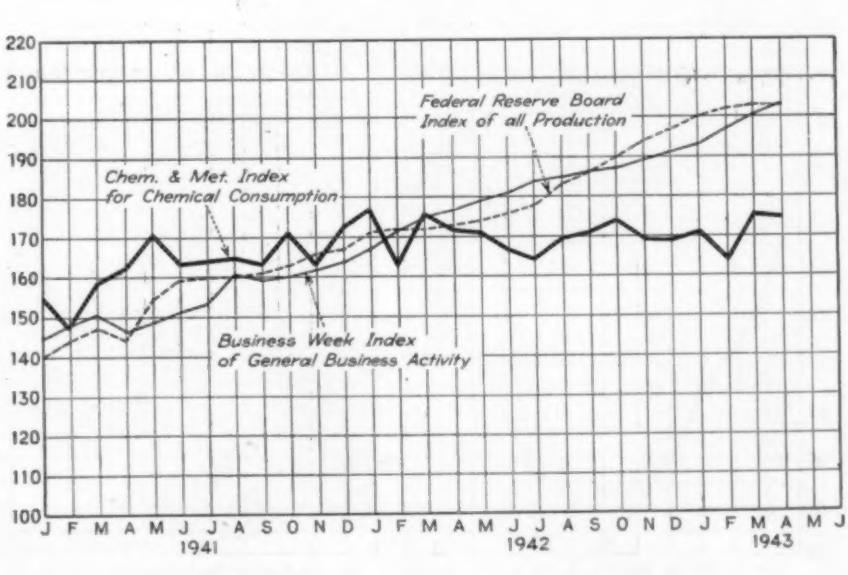
	March revised	April
Fertilizers	40.18	37.10
Pulp and paper	19.89	19.40
Petroleum refining	14.79	14.56
Glass	18.42	18.50
Paint and varnish	15.05	16.53
Iron and steel	13.86	13.42
Rayon	16.28	15.63
Textiles	12.58	11.82
Coal products	9.81	9.65
Leather	4.70	4.65
Industrial explosives	5.74	5.63
Rubber	3.00	3.00
Plastics	4.66	4.60
	178.96	174.49

Glass production continues to create new records as far as consumption of soda ash and other raw materials is concerned even though flat glass is making a very poor showing. Demand for containers has been running above the capacity to produce and it has been necessary to place restrictions on distribution. One of the mid-western container plants was forced to curtail work temporarily last month because of local flood conditions and this served to reduce the output.

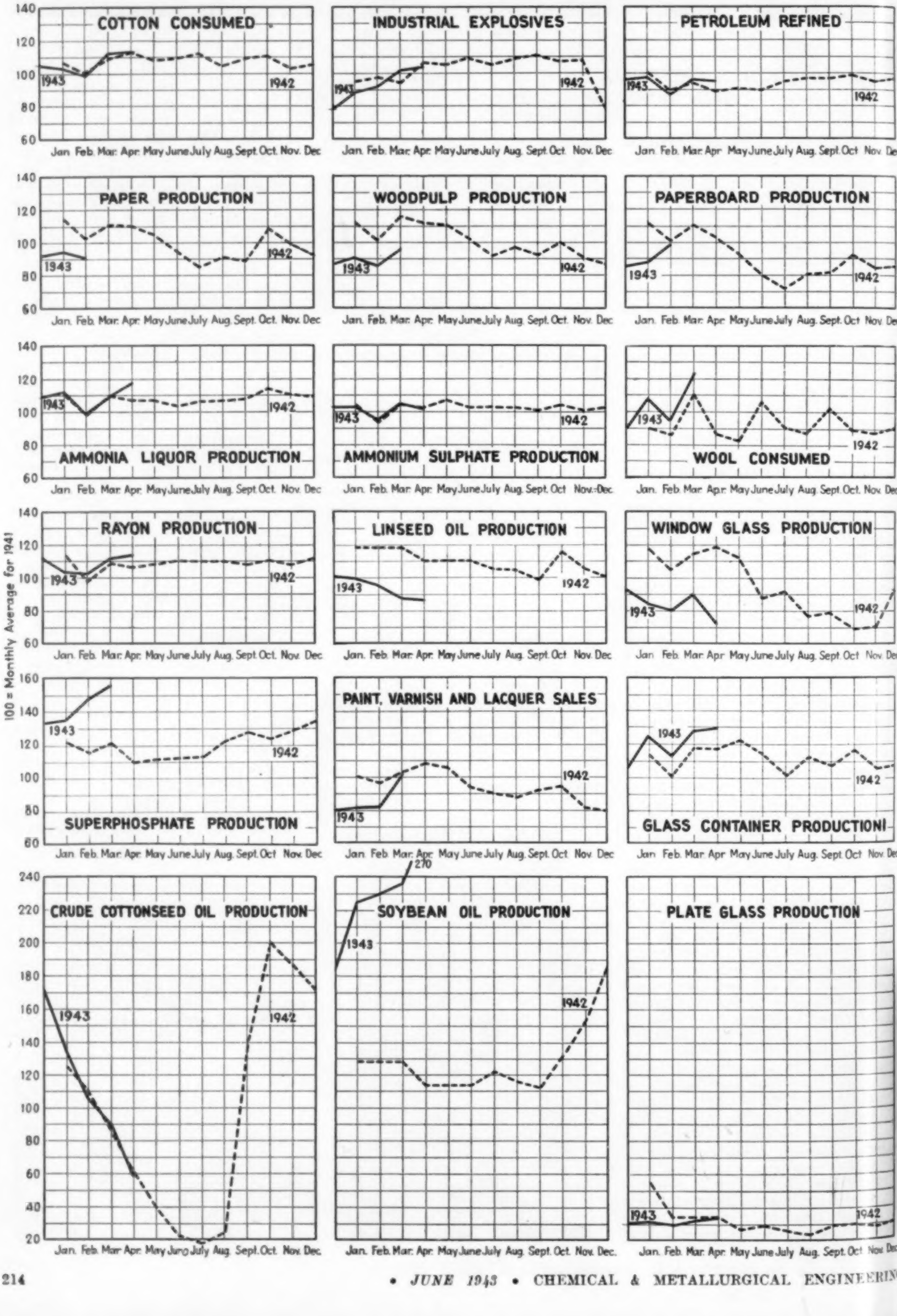
The American Potash Institute, Inc., has announced that deliveries of potash salts within the continental United States, Canada, Cuba, Puerto Rico and Hawaii by the four major producing companies during the first quarter of this year amounted to 346,254 short tons of salts, equivalent to 178,883 tons of actual K_2O. Constituting this total were 317,033 tons of salts, equivalent to 160,830 tons K_2O, designed for agricultural use, made up of 228,051 tons of muriate, 61,137 tons of manure salts, and 27,845 tons of sulphates. For chemical use deliveries amounted to 29,221 tons of salts, equivalent to 18,053 tons of K_2O. These figures include salts of domestic origin only.

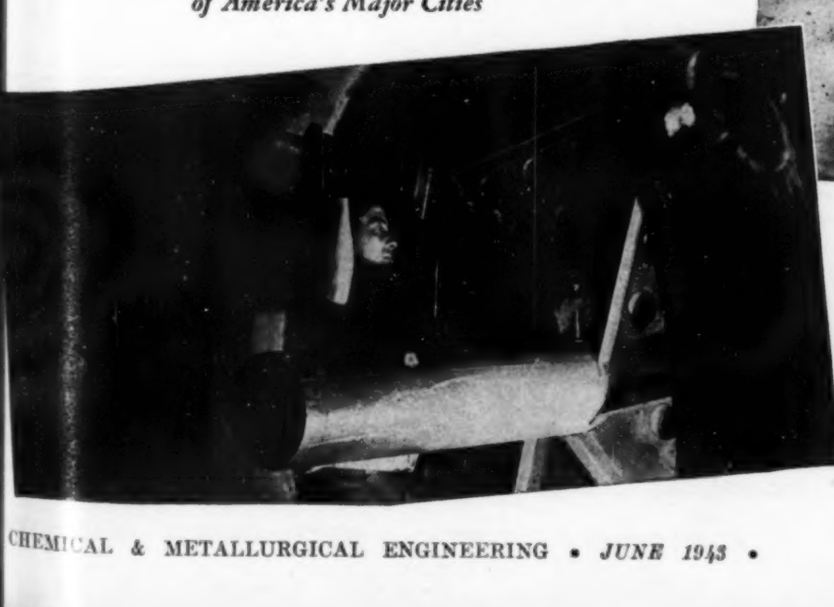
Compared with the first quarter of 1942, these deliveries represent an increase of 26,581 tons of potash salts, equivalent to 14,000 tons K_2O, from the total of 319,673 tons of salts, equivalent to 164,877 tons K_2O, delivered during the corresponding period of a year ago, an increase of 8 percent, principally in the category of agricultural salts.

For the twelve-month period, April 1, 1942 to March 31, 1943, total deliveries of potash salts amounted to 1,279,709 tons, equivalent to 674,161 tons K_2O, a 19 percent increase in salts and a 20 percent increase in K_2O equivalent over deliveries of the preceding twelve-month period.



Production and Consumption Trends





CITRIC ACID AND BUTYL ACETATE INCLUDED AMONG CHEMICALS UNDER ALLOCATION

As THE greater part of chemical output is sold ahead and moves out against contracts, current trading is not very important. However, there have been some inquiries for export involving good-sized lots but such demand seems to run heavily toward the chemicals which are in limited supply and actual business is restricted by the scarcity of offerings and by other difficulties surrounding export trade. While changes in the military program have made it possible to provide some chemicals in larger quantities for civilian lines, the number of selections which are scarce continues to increase. In the last month citric acid and butyl acetate, including normal and secondary, were placed under allocation. Isobutyl acetate, diphenyl mono phosphate, and dimono phenyl phosphate also were placed under distributional control.

It is pointed out that total productive capacity of refined citric acid in this country is 32,000,000 lb. made up of 7,000,000 lb. from citrus fruits and 25,000,000 lb. from the fermentation of molasses. Production for this year, however, is estimated at but little over 25,000,000 lb. as only about 1,500,000 lb. is expected to be made from lemons because of the reduction in the lemon crop and increased military demand for lemon juice. With production below capacity levels and demand steadily growing the market for citric acid has been very strong for some months and finally reached a point where the allocation measure was deemed necessary in order to assure equitable distribution of military and essential civilian uses.

The scarcity of butyl acetate is explained by the fact that since the first of the year, demand for butyl alcohol has been increased with the result that smaller amounts were available for conversion into the acetate. Tricresyl and triphenyl phosphates have been under allocation for some time and the adding of the two other phosphate plasticizers was for the purpose of meeting essential requirements.

Casein, likewise, has been of interest because imports from the Argentine have not been large enough to give an adequate supply and it has been evident for some time that some consumers would be forced to do without this material. WPB has announced that the supply for May and June was large enough to fill all military requests but requests for civilian use were cut in some cases to 30 percent of the requested totals.

Although imports of many materials have been irregular and in reduced quantities chrome ore has been reaching this country in relatively large volume and production of chrome salts has been above normal. In particular it is pointed out that domestic production of zinc chromate has reached an astonishing total as compared with any peace-time period and consumption is heavy enough to keep production of an ascending scale.

In the market for alcohol, the chief development consisted in an announcement to the effect that a new process for dehydrating and packaging molasses has been developed by the engineering division of the Board of Economic Warfare. It is further stated that the molasses treated by the new process is suitable, when reconstituted, only for the manufacture of alcohol and not for feedstuffs. In view of the shortage of tankers for transporting molasses from Cuba and other outside points, the new process gives promise of making molasses supplies more available. It is estimated that between 200,000,000 and 220,000,000 gal. of molasses are stored in Cuba, 60,000,000 gal. in the Dominican Republic, 65,000,000 gal. in Puerto Rico, and between 25,000,000 and 30,000,000 gal. in Haiti. The dehydrated product can be shipped in 40 percent less space than the fluid molasses. Because of the packaging angle, paper bag manufacturers have worked with BEW engineers on this project. To date everything has been carried out on an experimental scale and it will be necessary for interested users of the process to do further experimental work before going into large scale production. It is asserted that the dehydration operation can be done at sugar mills with the simplest of equipment and at small cost.

The easier position of chlorine is shown in the amendment to General Preference Order M-41 whereby large amounts of chlorinated hydrocarbon solvents are released for civilian uses. The amended order provides that a person requiring these solvents for any use for which a preference rating of B-[illegible] is assigned may receive in any month not more than his average monthly consumption during the base period of the year ending September 30, 1941.

Some improvement has been noted in demand for turpentine and values have turned upward. The market, however, is said to be stronger more because of relatively light offerings than to active buying. The Naval Stores Research Division of the Department of Agriculture has just issued its report on the naval stores industry for the 1942-43 season.

CHEM. & MET. Weighted Index of CHEMICAL PRICES

Base=100 for 1937

This month	109.[illegible]
Last month	108.[illegible]
June, 1942	109.[illegible]
June, 1941	100.[illegible]

While the greater part of chemical output is passing against contracts, high prices are paid for small lots in the spot market both for domestic use and for export. Nitrate of soda prices have been extended to cover June deliveries. Solvents displayed a strong tone in recent trading.

While all data connected with imports and exports have been excluded, the report brings out clearly the downward trend for consumption of turpentine and rosin. Apparent total consumption —including exports for 1942-43 was 427,954 50-gal. bbl. of turpentine as compared with 602,337 50-gal. bbl. for the preceding season. Consumption of rosin in the same periods were 1,899,145 500-lb. bbl. and 2,575,076 500-lb. bbl. respectively.

Production of turpentine in the 1942-43 season was 559,798 50-gal. bbl. as against 548,796 50-gal. bbl. in the preceding period. These totals included 321,930 bbl. of gum turpentine and 237,868 bbl. of wood turpentine for 1942-43 and 285,050 bbl. of wood turpentine and 263,746 bbl. of wood turpentine for 1941-42. Production of rosin for the year ended last March, amounted to 2,069,754 500-lb.-bbl. as compared with 2,135,593 500-lb. bbl. in the preceding fiscal year. Despite the drop in production stocks of turpentine increased during the year from 156,369 bbl. to 288,213 bbl. and stocks of rosin grew from 1,434,677 bbl. to 1,605,286 bbl.

Animal, neat's foot, and red oils have been added to the list that the War Food Administration is allocating to provide adequate supplies for meeting military, essential civilian, and lend-lease needs. These oils are highly important as metal working oils and are essential in textile weaving and processing, leather tanning, and in the manufacture of various specialized lubricants. Demand for them has increased with the acceleration of wartime industrial activity, and their shortage is magnified by the shortage of tallow and grease, the raw materials from which they are manufactured. Animal oils are defined to include grease (lard) oil, tallow oil, pig's feet oil as well as any other oil produced from animal fat.

They also are important substitutes for more commonly used sperm, castor and olive oils, and petroleum sulphanates—all of which are critical because of uncertain shipping conditions, and expanded demands.

Two sulphuric acid plants will be established in Bulgaria, say Axis press reports.

Permission for their erection has been given by the Bulgarian Industrial Council to one German and one Italian firm, it is stated.

CHEM. & MET.

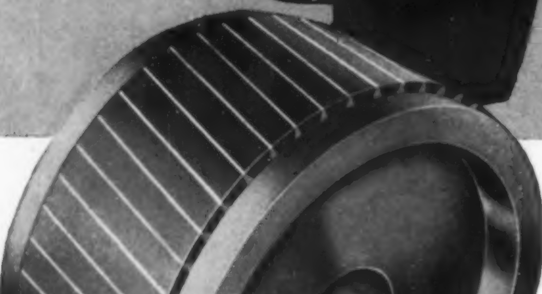
Weighted Index of Prices for

OILS & FATS

Base=100 for 1937

This month	145.55
Last month	146.03
June, 1942	143.60
June, 1941	112.00

Most important price development was the establishment of maximum prices for linseed oil. The basic price is fixed at 14.5c a lb. for raw oil, in tanks, delivered in Zone 1 which centers around Minneapolis. The usual differentials apply where oil is delivered in other containers.



REALLY, it's no hardship when you have to buy smaller motors. *You save money.* But remember, when you can't buy 'em big—buy 'em good.

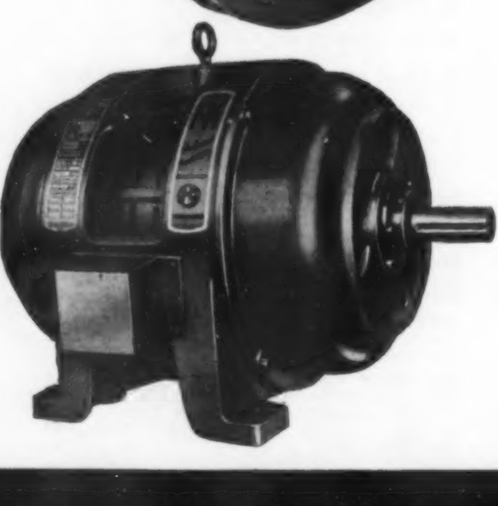
Now that you cannot depend on oversize to take your motors through tough service—you must depend on quality.

That is why you should investigate Fairbanks-Morse Motors with *Copperspun* Rotors.

The winding of the *Copperspun* Rotor is centrifugally cast of COPPER in one piece. It provides electrical and thermal characteristics that give this motor the stamina to stand up under the most severe service without mechanical failure. You can operate a Fairbanks-Morse Motor with *Copperspun* Rotor at its full rated capacity continuously and indefinitely without fear of damage from overloading.

Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill.

Copperspun



FAIRBANKS-MORSE Motors

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PUMPS
ELECTRICAL MACHINERY
SCALES
MOTORS

WATER SYSTEMS
FARM EQUIPMENT
STOKERS
AIR CONDITIONERS
RAILROAD EQUIPMENT

CURRENT PRICES

INDUSTRIAL CHEMICALS

	Current Price	Last Month	Last Year
Acetone, drums, lb	$0.085–$0.109	$0.085–$0.109	$0.168–$0.173
Acid, acetic, 28%, bbl., cwt	3.38 – 3.63	3.38 – 3.63	3.38 – 3.63
Glacial 99.5%, drums	9.15 – 9.40	9.15 – 9.40	9.15 – 9.40
U. S. P. X 1, 99.5%, dr	10.95 –11.20	10.95 –11.20	10.95 –11.20
Boric, bbl., ton	109.00–113.00	109.00–113.00	109.00–113.00
Citric, kegs, lb	.20 – .23	.20 – .23	.20 – .23
Formic, cbys, lb	.10½– .11	.10½– .11	.10½– .11
Gallic, tech., bbl., lb	1.10 – 1.15	1.10 – 1.15	1.10 – 1.15
Hydrofluoric 30% drums, lb	.08 – .08½	.08 – .08½	.08 – .08½
Lactic, 44%, tech., light, bbl., lb	.073– .075	.073– .075	.073– .075
Muriatic 18°, tanks, cwt	1.05 –......	1.05 –......	1.05 –......
Nitric, 36°, carboys, lb	.05 – .05½	.05 – .05½	.05 – .05½
Oleum, tanks, wks., ton	18.50 –20.00	18.50 –20.00	18.50 –20.00
Oxalic, crystals, bbl., lb	.11¼– .13	.11¼– .13	.11¼– .13
Phosphoric, tech., c'bys., lb	.07½– .08½	.07½– .08½	.07½– .08½
Sulphuric, 60°, tanks, ton	13.00 –......	13.00 –......	13.00 –......
Sulphuric, 66°, tanks, ton	16.50 –......	16.50 –......	16.50 –......
Tannic, tech., bbl., lb	.71 – .73	.71 – .73	.71 – .73
Tartaric, powd., bbl., lb	.70 –......	.70 –......	.70 –......
Tungstic, bbl., lb	nom	nom	nom ......
Alcohol, amyl	......–......	......–......	......–......
From Pentane, tanks, lb	.131–......	.131–......	.131–......
Alcohol, Butyl, tanks, lb	.10¾–......	.10¾–......	.158–......
Alcohol, Ethyl, 190 p'f., bbl., gal	11.94 –......	11.94 –......	8.19 – 8.25
Denatured, 190 proof	......–......	......–......	......–......
No. 1 special, dr., gal. wks	.62 –......	.62 –......	.60 –......
Alum, ammonia, lump, bbl., lb	.03¾– .04	.03¾– .04	.03¾– .04
Potash, lump, bbl., lb	.04¼– .04½	.04¼– .04½	.04 – .04¼
Aluminum sulphate, com. bags, cwt	1.15 – 1.40	1.15 – 1.40	1.15 – 1.40
Iron free, bg., cwt	1.85 – 2.10	1.85 – 2.10	1.85 – 2.10
Aqua ammonia, 26°, drums, lb	.02¼– .03	.02¼– .03	.02¼– .03
tanks, lb	.02 – .02¼	.02 – .02¼	.02 – .02¼
Ammonia, anhydrous, cyl., lb	.16 –......	.16 –......	.16 –......
tanks, lb	.04½–......	.04½–......	.04½–......
Ammonium carbonate, powd. tech., casks, lb	.09¼– .12	.09¼– .12	.09¼– .12
Sulphate, wks., ton	29.20 –......	29.20 –......	29.00 –......
Amylacetate tech., from pentane, tanks, lb	.145–......	.145–......	.145–......
Antimony Oxide, bbl., lb	.15 –......	.15 –......	.15 –......
Arsenic, white, powd., bbl., lb	.04 – .04¼	.04 – .04¼	.04 – .04¼
Red, powd., kegs, lb	nom	nom	nom ......
Barium carbonate, bbl., ton	60.00 –65.00	60.00 –65.00	60.00 –65.00
Chloride, bbl., ton	79.00 –81.00	79.00 –81.00	79.00 –81.00
Nitrate, casks, lb	.11 – .12	.11 – .12	.10¼– .11
Blanc fix, dry, bbl., lb	.03½– .04	.03½– .04	.03½– .04
Bleaching powder, f.o.b., wks., drums, cwt	2.25 – 2.35	2.25 – 2.35	2.25 – 2.35
Borax, gran., bags, ton	44.00 –......	44.00 –......	44.00 –......
Bromine, cs., lb	.30 – .32	.30 – .32	.30 – .32
Calcium acetate, bags	3.00 –......	3.00 –......	3.00 –......
Arsenate, dr., lb	.07 – .08	.07 – .08	.07 – .08
Carbide drums, lb	.04¾– .05	.04¾– .05	.04¾– .05
Chloride, fused, dr., del., ton	18.00 –24.00	18.00 –24.00	19.00 –24.50
flake, bags., del., ton	18.50 –25.00	18.50 –25.00	20.50 –25.00
Phosphate, bbl., lb	.07½– .08	.07½– .08	.07½– .08
Carbon bisulphide, drums, lb	.05¼–......	.05¼	.05¼–......
Tetrachloride drums, gal	.73 – .80	.73 – .80	.73 – .80
Chlorine, liquid, tanks, wks., 100 lb.	2.00 –......	2.00 –......	2.00 –......
Cylinders	.05¼– .06	.05¼– .06	.05¼– .06
Cobalt oxide, cans, lb	1.84 – 1.87	1.84 – 1.87	1.84 – 1.87
Copperas, bgs., f.o.b., wks., ton	18.00 –19.00	18.00 –19.00	18.00 –19.00
Copper carbonate, bbl., lb	.18 – .20	.18 – .20	.18 – .20
Sulphate, bbl., cwt	5.00 – 5.50	5.00 – 5.50	5.15 – 5.40
Cream of tartar, bbl., lb	.57 –......	.57 –......	.57 –......
Diethylene glycol, dr., lb	.14 – .15½	.14 – .15½	.14 – .15½
Epsom salt, dom., tech., bbl., cwt.	1.90 – 2.00	1.90 – 2.00	1.90 – 2.00
Ethyl acetate, drums, lb	.12 –......	.12 –......	.12 –......
Formaldehyde, 40%, bbl., lb	.05½– .06	.05½– .06¼	.05½– .06
Furfural, tanks, lb	.09 –......	.09 –......	.09 –......
Fusel oil, drums, lb	.18 – .19	.18 – .19	.18 – .19
Glaubers salt, bags, cwt	1.05 – 1.10	1.05 – 1.10	1.05 – 1.10
Glycerine, c.p., drums, extra, lb	.18¼–......	.18¼–......	.18¼–......

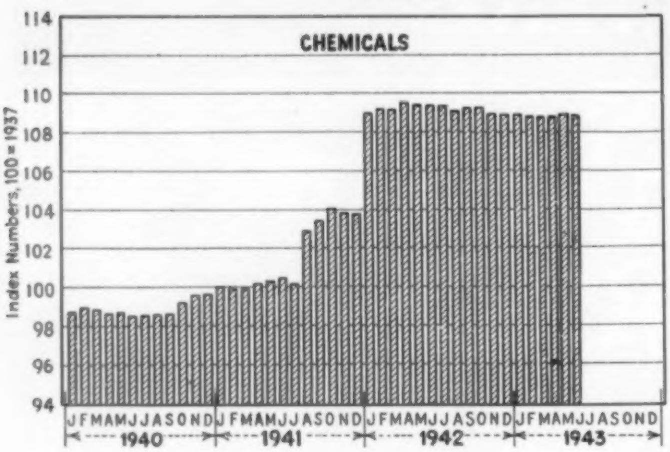
The accompanying prices refer to round lots in the New York market. Where it is the trade custom to sell f.o.b. works, quotations are given on that basis and are so designated. Prices are corrected to June 14

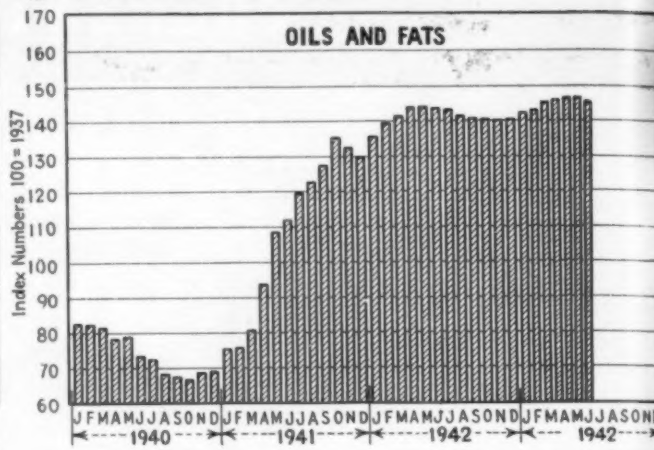
	Current Price	Last Month	Last Year
Lead:			
White, basic carbonate, dry casks, lb	.08¼–......	.08¼–......	.08¼–......
White, basic sulphate, sck., lb	.07¾–......	.07¾–......	.07¾–......
Red, dry, sck., lb	.09½–......	.09½–......	.09½–......
Lead acetate, white crys., bbl., lb	.12¾– .13	.12¾– .13	.12¾– .13
Lead arsenate, powd., bag, lb	.11 – .12	.11 – .12	.11 – .12
Lime, chem., bulk, ton	8.50 –......	8.50 –......	8.50 –......
Litharge, powd., csk., lb	.08½–......	.08½–......	.08½–......
Lithopone, bags, lb	.04¼– .04½	.04¼– .04½	.04¼– .04½
Magnesium carb., tech., bags, lb	.06¼– .06½	.06¼– .06½	.06¼– .06½
Methanol, 95%, tanks, gal	.58 –......	.58 –......	.60 –......
97%, tanks, gal	.58 –......	.58 –......	.60 –......
Synthetic, tanks, gal	.28 –......	.28 –......	.28 –......
Nickel salt, double, bbl., lb	.13¼– .13½	.13¼– .13½	.13¼– .13½
Orange mineral, csk., lb	.12½–......	.12½–......	.12½–......
Phosphorus, red, cases, lb	.40 – .42	.40 – .42	.40 – .42
Yellow, cases, lb	.18 – .25	.18 – .25	.18 – .25
Potassium bichromate, casks, lb	.09⅝– .10	.09⅝– .10	.09⅝– .10
Carbonate, 80–85%, calc. csk., lb	.06½– .07	.06½– .07	.06½– .07
Chlorate, powd., lb	.10 – .12	.10 – .12	.10 – .12
Hydroxide (c'stic potash) dr., lb	.07 – .07¼	.07 – .07¼	.07 – .07¼
Muriate, 60% bags, unit	.53½–......	.53½–......	.53½–......
Nitrate, bbl., lb	.05½– .06	.05½– .06	.05½– .06
Permanganate, drums, lb	.19½– .20	.19½– .20	.19½– .20
Prussiate, yellow, casks, lb	.17 – .18	.17 – .18	.17 – .18
Sal ammoniac, white, casks, lb	.0515– .06	.0515– .06	.0515– .06
Salsoda, bbl., cwt	1.00 – 1.05	1.00 – 1.05	1.00 – 1.05
Salt cake, bulk, ton	17.00 –......	17.00 –......	17.00 –......
Soda ash, light, 58%, bags, contract, cwt	1.05 –......	1.05 –......	1.05 –......
Dense, bags, cwt	1.10 –......	1.10 –......	1.10 –......
Soda, caustic, 76%, solid, drums, cwt	2.30 – 3.00	2.30 – 3.00	2.30 – 3.00
Acetate, del., bbl., lb	.05 – .06	.05 – .06	.05 – .06
Bicarbonate, bbl., cwt	1.70 – 2.00	1.70 – 2.00	1.70 – 2.00
Bichromate, casks, lb	.07⅝– .08	.07⅝– .08	.07⅝– .08
Bisulphate, bulk, ton	16.00 –17.00	16.00 –17.00	16.00 –17.00
Bisulphite, bbl., lb	.03 – .04	.03 – .04	.03 – .04
Chlorate, kegs, lb	.06¼– .06½	.06¼– .06½	.06¼– .06½
Cyanide, cases, dom., lb	.14 – .15	.14 – .15	.14 – .15
Fluoride, bbl., lb	.08 – .09	.08 – .09	.08 – .09
Hyposulphite, bbl., cwt	2.40 – 2.50	2.40 – 2.50	2.40 – 2.50
Metasilicate, bbl., cwt	2.50 – 2.65	2.50 – 2.65	2.50 – 2.65
Nitrate, bulk, cwt	1.35 –......	1.35 –......	1.35 –......
Nitrite, casks, lb	.06⅝– .07	.06⅝– .07	.06⅝– .07
Phosphate, tribasic, bags, lb	2.70 –......	2.70 –......	2.70 –......
Prussiate, yel. drums, lb	.10½– .11	.10½– .11	.10½– .11
Silicate (40° dr.), wks., cwt	.80 – .85	.80 – .85	.80 – .85
Sulphide, fused, 60–62%, dr. lb	.03 – .03½	.03 – .03½	.03 – .03½
Sulphite, crys., bbl., lb	.02¼– .02½	.02¼– .02½	.02¼– .02½
Sulphur, crude at mine, long ton	16.00 –......	16.00 –......	16.00 –......
Chloride, dr., lb	.03 – .04	.03 – .04	.03 – .04
Dioxide, cyl., lb	.07 – .08	.07 – .08	.07 – .08
Flour, bag, cwt	1.90 – 2.40	1.90 – 2.40	1.90 – 2.40
Tin Oxide, bbl., lb	.55 –......	.55 –......	.55 –......
Crystals, bbl., lb	.39½–......	.39½–......	.39½–......
Zinc, chloride, gran., bbl., lb	.05¾– .06	.05¾– .06	.05 – .06
Carbonate, bbl., lb	.14 – .15	.14 – .15	.14 – .15
Cyanide, dr., lb	.33 – .35	.33 – .35	.33 – .35
Dust, bbl., lb	.1035–......	.1035–......	.10¼–......
Oxide, lead free, bag, lb	.07¼–......	.07¼–......	.07¼–......
5% leaded, bags, lb	.07⅛–......	.07⅛–......	.07⅛–......
Sulphate, bbl., cwt	3.85 – 4.00	3.85 – 4.00	3.40 – 3.50

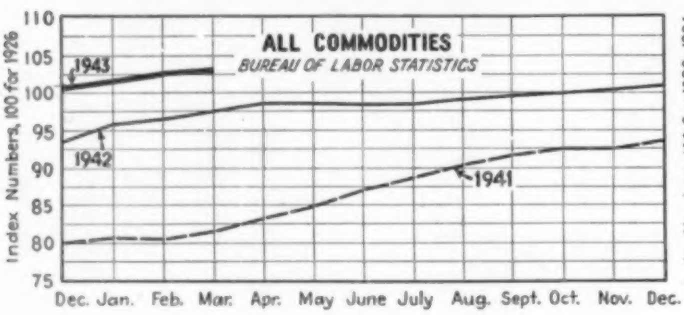
OILS AND FATS

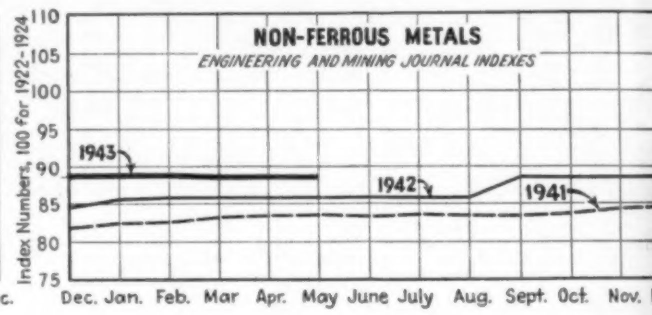
	Current Price	Last Month	Last Year
Castor oil, No. 3 bbl., lb	$0.13¾–$0.14½	$0.13¾–$0.14½	$0.13¾–$0.14½
Chinawood oil, bbl., lb	.38 –......	.38 –......	.38 –......
Coconut oil, Ceylon, tank, N. Y., lb	nom	nom	nom ......
Corn oil crude, tanks (f.o.b. mill), lb	.12¾–......	.12¾–......	.12¾–......
Cottonseed oil, crude (f.o.b. mill), tanks, lb	.12¾–......	.12¾–......	.12¾–......
Linseed oil, raw car lots, bbl., lb	.153–......	.156–......	.139–......
Palm, casks, lb	.09 –......	.09 –......	.09 –......
Peanut oil, crude, tanks (mill), lb	.13 –......	.13 –......	.13 –......
Rapeseed oil, refined, bbl., lb	nom	nom	nom ......
Soya bean, tank, lb	.11¾–......	.11¾–......	.11¾–......
Sulphur (olive foots), bbl., lb	nom	nom	.19¼–......
Cod, Newfoundland, bbl., gal	nom	nom	nom ......
Menhaden, light pressed, bbl., lb	.117–......	.117–......	.114–......
Crude, tanks (f.o.b. factory) lb	.088–......	.088–......	.088–......
Grease, yellow, loose, lb	.08¼–......	.08¼–......	.09295......
Oleo stearine, lb	.09½–......	.09½–......	.09½–......
Oleo oil, No. 1	.11½–......	.11½–......	.11½–......
Red oil, distilled, dp.p. bbl., lb	.11¾–......	.11¾–......	.12 –......
Tallow extra, loose, lb	.08⅝–......	.08⅝–......	.097125....

Chem. & Met.'s Weighted Price Indexes









Coal-Tar Products

	Current Price	Last Month	Last Year
Alpha-napthol, crude bbl., lb.	$0.52- $0.55	$0.52- $0.55	$0.52 -$0.55
Alpha-naphthylamine, bbl., lb.	.32 - .34	.32 - .34	.32 - .34
Aniline oil, drums, extra, lb.	.15 - .16	.15 - .16	.15 - .16
Aniline, salts, bbl., lb.	.22 - .24	.22 - .24	.22 - .24
Benzaldehyde, U.S.P., dr., lb.	.85 - .95	.85 - .95	.85 - .95
Benzidine base, bbl., lb.	.70 - .75	.70 - .75	.70 - .75
Benzoic acid, U.S.P., kgs., lb.	.54 - .56	.54 - .56	.54 - .56
Benzyl chloride, tech., dr., lb.	.23 - .25	.23 - .25	.23 - .25
Benzol, 90%, tanks, works, gal.	.15 -......	.15 -......	.14 -......
Beta-naphthol, tech., drums, lb.	.23 - .24	.23 - .24	.23 - .24
Cresol, U.S.P., dr., lb.	.11 -......	.11 - .11	.10¾- .11
Cresylic acid, dr., wks., gal.	.81 - .83	.81 - .83	.81 - .83
Diethylaniline, dr., lb.	.40 - .45	.40 - .45	.40 - .45
Dinitrophenol, bbl., lb.	.23 - .25	.23 - .25	.23 - .25
Dinitrotoluol, bbl., lb.	.18 - .19	.18 - .19	.18 - .19
Dip oil, 15%, dr., gal.	.23 - .25	.23 - .25	.23 - .25
Diphenylamine, dr. f.o.b. wks., lb.	.60 -......	.60 -......	.70 -......
H-acid, bbl., lb.	.45 - .50	.45 - .50	.45 - .50
Naphthalene, flake, bbl., lb.	.07 - .07½	.07 - .07½	.07 - .07½
Nitrobenzene, dr., lb.	.08 - .09	.08 - .09	.08 - .09
Para-nitraniline, bbl., lb.	.47 - .49	.47 - .49	.47 - .49
Phenol, U.S.P., drums, lb.	.10½- .11	.10½- .11	.13 -......
Picric acid, bbl., lb.	.35 - .40	.35 - .40	.35 - .40
Pyridine, dr., gal.	1.70 - 1.80	1.70 - 1.80	1.70 - 1.80
Resorcinol, tech., kegs., lb.	.75 - .80	.75 - .80	.75 - .80
Salicylic acid, tech., bbl., lb.	.33 - .40	.33 - .40	.33 - .40
Solvent naphtha, w.w., tanks, gal.	.27 -......	.27 -......	.27 -......
Tolidine, bbl., lb.	.86 - .88	.86 - .88	.86 - .88
Toluol, drums, works, gal.	.33 -......	.33 -......	.32 -......
Xylol, com., tanks, gal.	.26 -......	.26 -......	.26 -......

Miscellaneous

	Current Price	Last Month	Last Year
Barytes, grd., white, bbl., ton.	$22.00-$25.00	$22.00-$25.00	$22.00-$25.00
Casein, tech., bbl., lb.	.21 - .23½	.21 - .23½	.17- .20
China clay, dom., f.o.b. mine, ton.	8.00 -20.00	8.00 -20.00	8.00 -20.00
Dry colors			
Carbon gas, black (wks.), lb.	.0335- .30	.0335- .30	.0335- .30
Prussian blue, bbl., lb.	.36 - .37	.36 - .37	.36 - .37
Ultramarine blue, bbl., lb.	.11 - .26	.11 - .26	.11 - .26
Chrome green, bbl., lb.	.21½- .30	.21½- .30	.21½- .30
Carmine, red, tins, lb.	4.60 - 4.75	4.60 - 4.75	4.60 - 4.75
Para toner, lb.	.75 - .80	.75 - .80	.75 - .80
Vermilion, English, bbl., lb.	3.05 - 3.10	3.05 - 3.10	3.05 - 3.10
Chrome yellow, C.P., bbl., lb.	.14½- .15½	.14½- .15½	.14½- .15½
Feldspar, No. 1 (f.o.b.N.C.), ton.	6.50 - 7.50	6.50 - 7.50	6.50 - 7.50
Graphite, Ceylon, lump, bbl., lb.	.08 - .10	.08 - .10	.08 - .10
Gum copal Congo, bags, lb.	.09 - .30	.09 - .30	.09 - .30
Manila, bags, lb.	.09 - .15	.09 - .14	.09 - .15
Demar, Batavia, cases, lb.	.10 - .22	.10 - .20	.10 - .22
Kauri, cases, lb.	.18 - .60	.17 - .60	.18 - .60
Kieselguhr (f.o.b. mines), ton.	7.00 -40.00	7.00 -40.00	7.00 -40.00
Magnesite, calc, ton.	64.00 -......	64.00 -......	64.00 -......
Pumice stone, lump, bbl., lb.	.05 - .07	.05 - .08	.05 - .07
Imported, casks, lb.	nom	nom	nom ......
Rosin, H., 100 lb.	4.09 -......	4.10 -......	3.33 -......
Turpentine, gal.	.73½-......	.70½-......	.67 -......
Shellac, orange, fine, bags, lb.	.39 -......	.39 -......	.43 -......
Bleached, bonedry, bags, lb.	.39 -......	.39 -......	.40 -......
T. N. bags, lb.	.31 -......	.31 -......	.32 -......
Soapstone (f.o.b. Vt.), bags, ton.	10.00 -12.00	10.00 -12.00	10.00 -12.00
Talc. 200 mesh (f.o.b. Vt.), ton.	8.00 - 8.50	8.00 - 8.50	8.00 - 8.50
200 mesh (f.o.b. Ga.), ton.	6.00 - 8.00	6.00 - 8.00	6.00 - 8.00

Industrial Notes

THE H. K. FERGUSON CO., Cleveland, has appointed J. Stuart Sneddon vice-president in charge of sales. Clarence McDonough, who did special work in synthetic rubber and ordnance plant construction, will resume his position as vice-president in charge of construction.

THE PERMANENTE CORP., Oakland, Calif., has changed its name to the Permanente Cement Co.

GENERAL CONTROLS CO., Glendale, Calif., has appointed Claude S. Slocum as its representative in the Rocky Mountain and adjacent territory. He will make his headquarters at 2135 South Adams St., Denver, Col.

HENRY L. CROWLEY & CO., INC., West Orange, N. J., has appointed L. A. Shea district manager for the Chicago territory and named Ralph Hulton field engineer in the Ohio and Michigan territories.

KELLY O'LEARY STEEL WORKS, Chicago, has added Roy E. Smith to its executive staff where he will serve as sales manager.

WISHNICK-TUMPEER, INC., New York, again has Clement A. Damen on its sales staff. Mr. Damen had left the company to work with the Army Medical Corps.

THE CHARLES S. JACOBOWITZ CO., Buffalo, together with its affiliate, the Niagara Filter Corp., has moved to 3080 Main St.

SULLIVAN MACHINERY CO., Michigan City, Ind., has appointed O. J. Neslage general sales manager and J. N. Rolston assistant general sales manager.

AMERICAN PIPE & CONSTRUCTION Co., Los Angeles, is now represented in Canada by Gunite and Waterproofing, Ltd., 1538 Sherbrooke St., W. Montreal.

RODNEY HUNT MACHINE Co., Orange, Mass., has placed Harold H. Belcher in charge of engineering and development work for the textile machinery division.

HERCULES POWDER Co., Wilmington, has appointed Arthur H. Sanford manager of naval stores sales at the Boston office. Hind and Connor, Inc., Boston, will continue as distributors in the New England area.

KESSLER CHEMICAL Co., Philadelphia, has moved its offices to State Road and Cottman Ave.

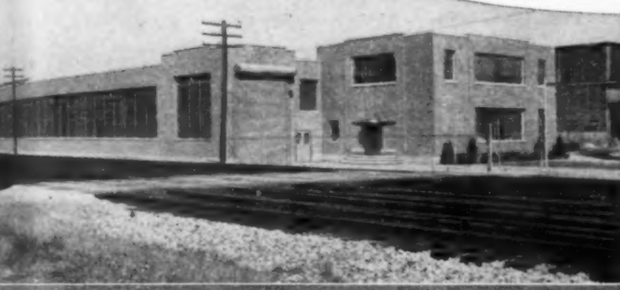
For the Emergency.. AND A LONG TIME AFTER!

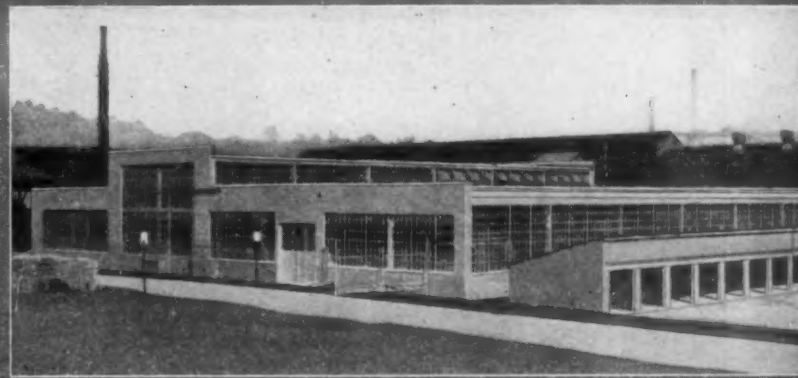
INDUSTRIAL BUILDINGS
and PLANT ADDITIONS

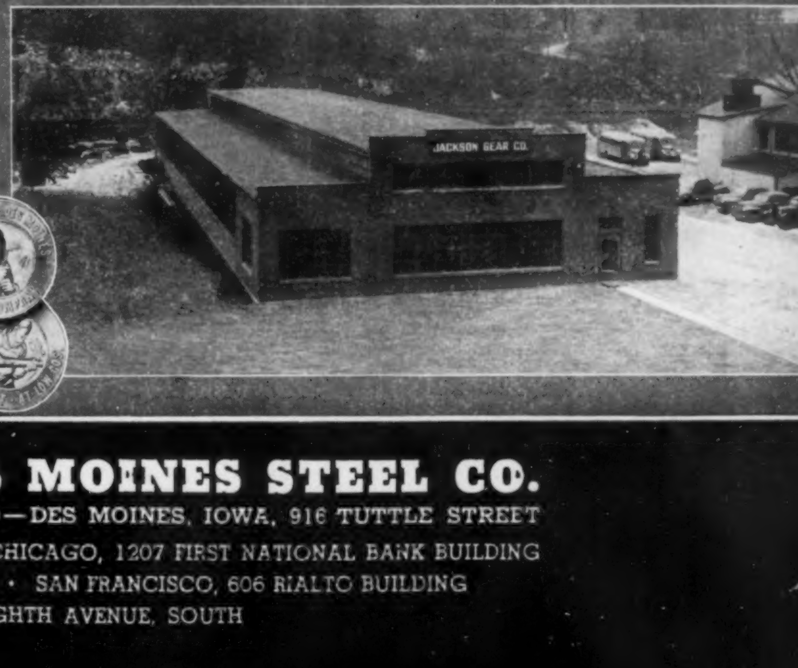
DESIGNED, FABRICATED AND ERECTED BY . . .

PITTSBURGH • DES MOINES

Furnished under one contract, one responsibility—on schedules of pressing urgency—these typical examples of recent Pittsburgh-Des Moines construction are *built to endure*. The complete facilities of this organization, as experienced building contractors in the industrial field, are at your service—with satisfaction guaranteed!







PITTSBURGH • DES MOINES STEEL CO.

PITTSBURGH, PA. 3417 NEVILLE ISLAND—DES MOINES, IOWA, 916 TUTTLE STREET

NEW YORK, ROOM 990, 270 BROADWAY • CHICAGO, 1207 FIRST NATIONAL BANK BUILDING

DALLAS, 1216 PRAETORIAN BUILDING • SAN FRANCISCO, 606 RIALTO BUILDING

SEATTLE, 1107 EIGHTH AVENUE, SOUTH

NEW CONSTRUCTION

	Current Projects		Cumulative 1943	
	Proposed Work	Contracts	Proposed Work	Contracts
New England	$175,000	$45,000	$295,000	$250,000
Middle Atlantic	140,000	....	14,070,000	1,900,000
South	4,650,000	1,000,000	6,863,000	6,600,000
Middle West	....	40,000	8,530,000	8,535,000
West of Mississippi	1,690,000	1,405,000	12,300,000	9,470,000
Far West	75,000	50,000,000	1,925,000	57,126,000
Canada	580,000	....	4,824,000	1,127,000
Total	$7,310,000	$52,490,000	$48,807,000	$85,108,000

PROPOSED WORK

Calif., Berkeley—Cutter Laboratories, 4th and Parker Sts., plan to construct additional plant facilities. Project will be financed by Defense Plant Corp., Washington, D. C. Estimated cost $75,000.

Colorado—Bureau of Mines, Department of Interior, Washington, D. C., plans to construct a helium manufacturing plant in the Thatcher area.

Ia., Dike—Farmers Cooperative Elevator, Dike, plans the construction of a soybean processing plant. Estimated cost including equipment $40,000.

Ia., Muscatine—Muscatine Processing Corp., S. C. Stern, Pres., plans the construction of a soybean processing plant. Estimated cost $200,000.

Kansas—Bureau of Mines, Department of Interior, Washington, D. C., plans the construction of a helium manufacturing plant in the area of Cunningham.

Kansas—Bureau of Mines, Department of Interior, Washington, D. C., plans the construction of a helium manufacturing plant in the area of Otis.

Kansas—Midwest Solvents Co., Atchison, plans to construct additional plant facilities. Project will be financed by Defense Plant Corp., Washington, D. C. Estimated cost $300,000.

Kentucky—Reynolds Metals Co., 311 West Broadway, Louisville, plans to construct additional plant facilities. Defense Plant Corp., Washington, D. C., will finance. Estimated cost $250,000.

Montana—Domestic Manganese & Development Co., South Montana St., Butte, plans to construct additional plant facilities. Defense Plant Corp., Washington, D. C., will finance. Estimated cost $250,000.

N. H., Nashua—Nashua Gummed & Coated Paper Co., 44 Franklin St., is having plans prepared by Sidney Hooper Archt., 199 Washington St., Boston, Mass., for the construction of a warehouse. Estimated cost $175,000.

New Jersey—Casob Corp., c/o Irving Varnish Co., 6 Argyle Terrace, Irvington, plans to alter and construct 1 story addition to its plant. Estimated cost $40,000.

N. J., Newark—New Jersey Galvanizing & Tinning Works, foot of Pacific St., are having plans prepared by Victor Strombach, Archt., 1243 Springfield Ave., for the construction of a 1 story, 77x165 ft. manufacturing plant. Estimated cost $100,000.

New Mexico—Bureau of Mines, Department of Interior, Washington, D. C., plans to construct and equip a helium manufacturing plant in the area of Shiprock.

Tex., Beaumont—Southern Acid & Sulphur Co., Beaumont, and 7621 Walisville Rd., Houston, plans to construct an addition to its acid and sulphur plant here. Chemical Construction Co., Houston, Engr. Estimated cost $700,000.

Tex., Columbus—Southern Products & Silica Co., Lilesville, N. C., plans to move two of its large mill units from Lilesville to Columbus and construct tumbling mill to process flint rocks for paint ceramics and other products.

Virginia—E. I. du Pont de Nemours & Co., Inc., du Pont Bldg., Wilmington, Del., plans to enlarge its plants in Henrico and Chesterfield Counties and in New York State. Project will be financed by Defense Plant Corp., Washington, D. C. Estimated cost $4,400,000.

Alberta—Dominion Government, Ottawa, Ont., Can., has taken over the plant of the Abasand Oils, Ltd., McMurray, and plans to reconstruct same. Estimated cost $500,000.

Ont., Windsor—Winthrop Chemical Co., Inc., c/o H. L. Schade, Windsor, plans to construct a plant for the manufacture of medicinal, chemical and pharmaceutical compounds. Estimated cost $40,000.

Ont., Windsor—Wolverine Chemicals, Inc., c/o H. C. Shotwell, Windsor, plans to construct a plant for the manufacture of pharmaceutical, chemical and industrial compounds. Estimated cost $40,000.

CONTRACTS AWARDED

California—Texas Co., 135 East 42nd St., New York, N. Y., and 929 South Bway., Los Angeles, will adapt present refinery to produce 100 octane gasoline. Part of work will be done by own forces; alkylation system and feed preparation by Foster-Wheeler Corp., 715 West Olympic Blvd., Los Angeles. Estimated cost $50,000,000.

Mass., Southbridge—American Optical Co., 14 Mechanic St., has awarded the contract for the construction of a 4 story, 50x60 ft. factory addition to H. P. Cummings Construction Co., 14 Prospect St., Ware. Estimated cost $45,000.

Tennessee—Tennessee Eastman Kodak Co., Knoxville, and E. I. du Pont de Nemours & Co., du Pont Bldg., Wilmington, Del., have awarded the contract for the construction of a manufacturing plant in Roane and Anderson Counties, to Stone & Webster Engineering Corp., 90 Broad St., New York, N. Y. Project will be financed by Defense Plant Corp., Washington, D. C.

Texas—Republic Oil Refining Co., Texas City, has awarded the contract for the construction of a refinery to Bace-Marshall Co., 4009 Center St., Houston, Defense Plant Corp., Washington, D. C., will finance project. Estimated cost $180,000.

Tex., Conroe—Columbian Carbon Co., Houston and Rosslyn Rds., Houston, will construct a carbon black plant for synthetic rubber. Work will be done by separate contracts. Present appropriation $1,225,000; total estimated cost $3,000,000.

Wis., New Richmond—Doughboy Mills Chemical Co., New Richmond, will construct a 2 story, 36x36 ft. pilot plant for Plant "K". Work will be done by day labor.

Bottlenecks!

Labor Shortage?

Do you use any men unnecessarily? Processing is a *machine* industry!

Weak-Sister Machinery?

Some machines that used to "get by" need too much maintenance today.

Overworked Engineers?

Outside engineering cooperation might solve many problems quickly.

CHALMERS!

commend some *one* type. *What you need* dictates their commendations, *not what they've got!*

If you have a bottleneck to break, Allis-Chalmers Cooperative ngineering is ready to help. Call your nearby district office. r write ALLIS-CHALMERS, MILWAUKEE, WISCONSIN.

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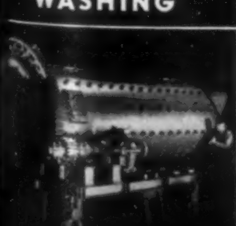
WE WORK FOR VICTORY — WE PLAN FOR PEACE

Models of processing machinery in Allis-Chalmers laboratories reproduce conditions in your plant — help eliminate guesswork!

WASHING

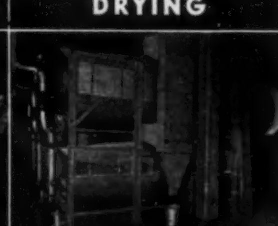


a & mill type washers — l line of washing screens.

PYRO-PROCESSING

Multiple & flat hearth furnaces—rotary calcining kilns.

DRYING



Rotary & hearth furnace dryers —revolving steam-tube dryers.

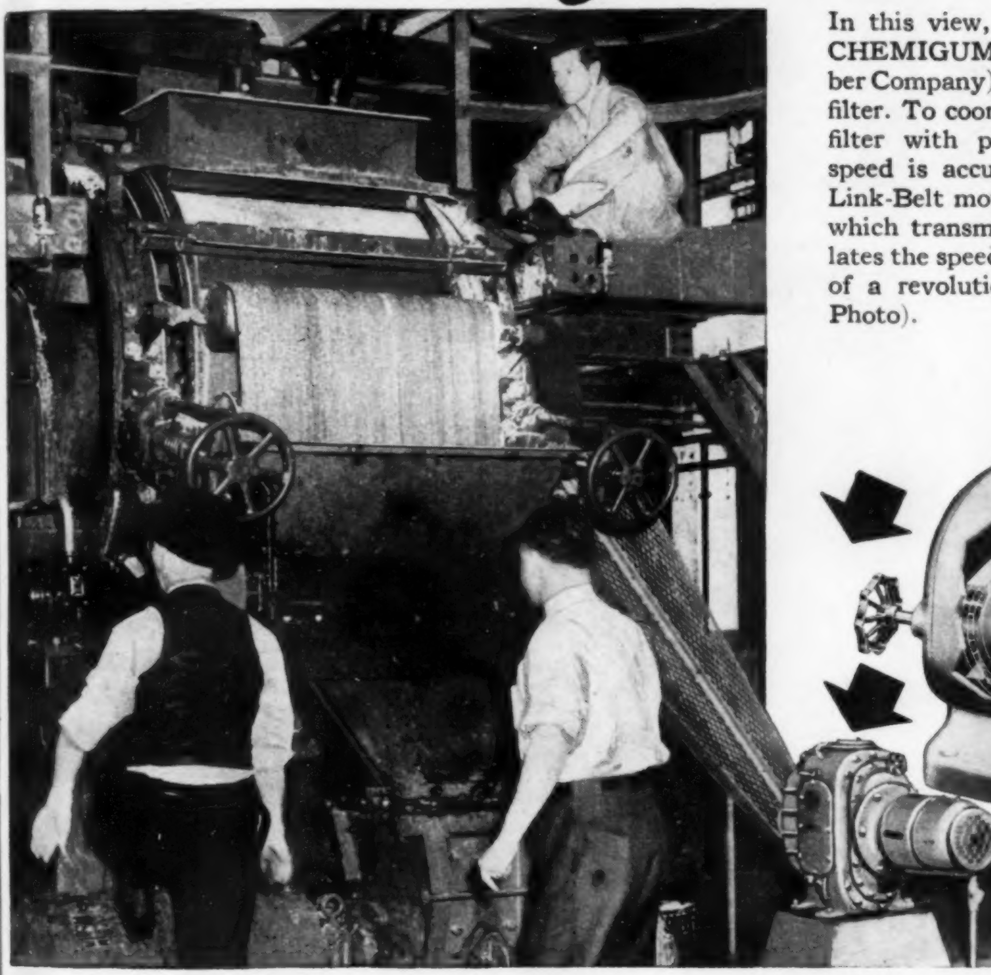
MILLING

Milling & oil-extraction of cereals — chemical reduction.

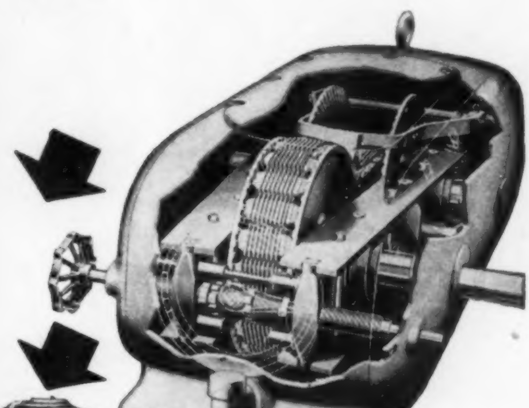
SIFTING

Gyratory sifters & sifting reels for cereals, minerals, chemicals.

Rivers of Rubber!



In this view, a stream of coagulated CHEMIGUM (Goodyear Tire & Rubber Company) is rolling off a continuous filter. To coordinate the output of the filter with preceding operations, its speed is accurately regulated by the Link-Belt motorized P.I.V. Gear unit, which transmits the power and regulates the speed to the minutest fraction of a revolution. (International News Photo).



Split-second speed control for vital filtering process!

Filtered CHEMIGUM comes from the continuous filter in a sheet or film, the thickness determined by the speed of the filter. Efficient operation of the entire process is aided by accurate regulation of the flow of filtered material. The Link-Belt P.I.V. Gear variable speed unit is ideally suited to this operation because the speed can be varied infinitely within the full range of the unit. Once selected, the chosen speed is maintained accurately. It employs a positive drive chain, which eliminates any possibility of slippage. It is entirely independent of friction Speed changes are made while the drive is in operation.

Precise, positive speed control, in any type of industrial application, can be obtained by use of the P.I.V. Gear. It is built in a wide range of sizes and types. Send for book 1874.

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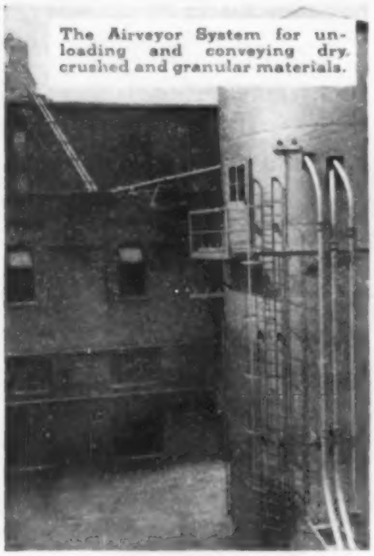
LINK-BELT P.I.V. GEAR

POSITIVE INFINITELY VARIABLE SPEED CONTROL

FULLER

serves

The Chemical Industries

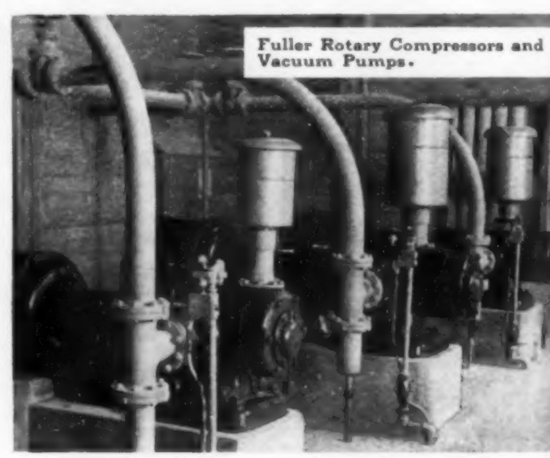

The Airveyor System for unloading and conveying dry, crushed and granular materials.


Fuller-Kinyon Remote-Control Unloader.

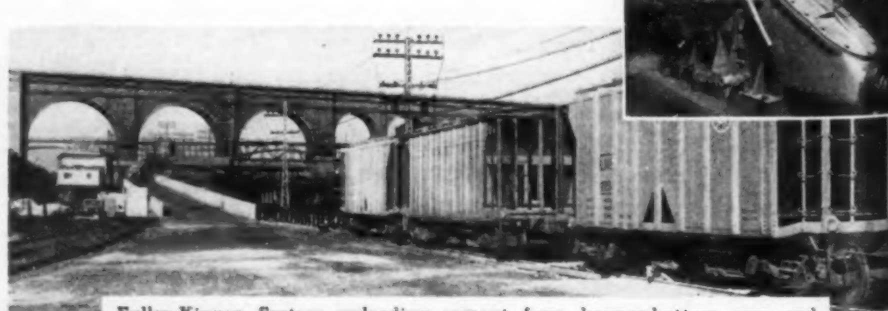

Right: Fuller Rotary Feeder for dry pulverized materials.

Pioneers in developing and building equipment to solve the industry's problems.


Air-Quenching Cooler for cement clinker, lime, ores, etc.


Fuller Rotary Compressors and Vacuum Pumps.


Dry Pulverized-Material Cooler.


Fuller-Kinyon System unloading cement from hopper-bottom cars and conveying to storage in ready-mix plant.

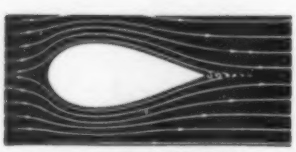
Literature covering any of the above equipment will be sent you on request.

G-33

FULLER COMPANY

CATASAUQUA—PENNSYLVANIA

CHICAGO—Marquette Bldg. SAN FRANCISCO—Chancery Bldg.



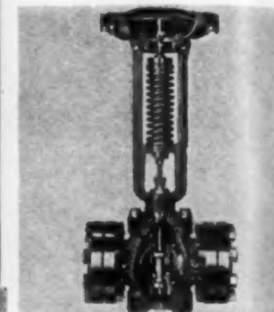
"Even though shifts come one after the other nowadays, yours truly stays on the job. Once they put me on the line I am IN—they don't find me out of order—no time-outs for repairs. I have accuracy and capacity. Peak loads or sharp changes in demand don't bother me. Why I have been known time after time to have been on the line so many years without needing even a little attention that the boys in charge forgot all about me. If they had a time card for me it would have shown a big zero after the word 'absenteeism.' Guess it's what a fellow is made of after all that counts—I am free of small ports and passages and complicated mechanism—also I have but few close fitting parts. The big secret is that I am Streamlined."

TROUBLE-FREE SERVICE	CONSTANT DELIVERY PRESSURE
SMOOTH OPERATION	PRACTICALLY ZERO IN MAINTENANCE COST
TIGHT CLOSURE	SPEEDIER PRODUCTION RESULTS
NO SPOILAGE	COST-SAVING OPERATION

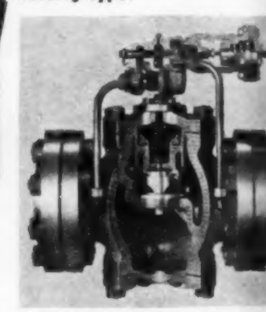
CASH STANDARD
CONTROLS.. VALVES

A. W. CASH COMPANY
DECATUR, ILLINOIS

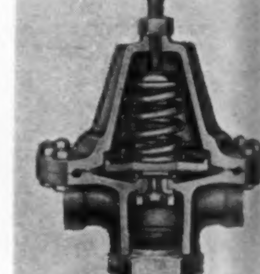
OTHER VALVES *from the* CASH STANDARD LINE



Cash Standard Type 34, Pressure Reducing Valve. For practically all fluids. Sizes: 1/2" to 12" inclusive. Highest initial pressure 800 lbs.; reduced pressure, vacuum to 150 lbs.
Has roller guides, roller bearing—no lost motion.
Bodies: iron, bronze, steel. Trim: iron, bronze, stainless steel. Ends: screwed, flanged, ammonia type, welding type.



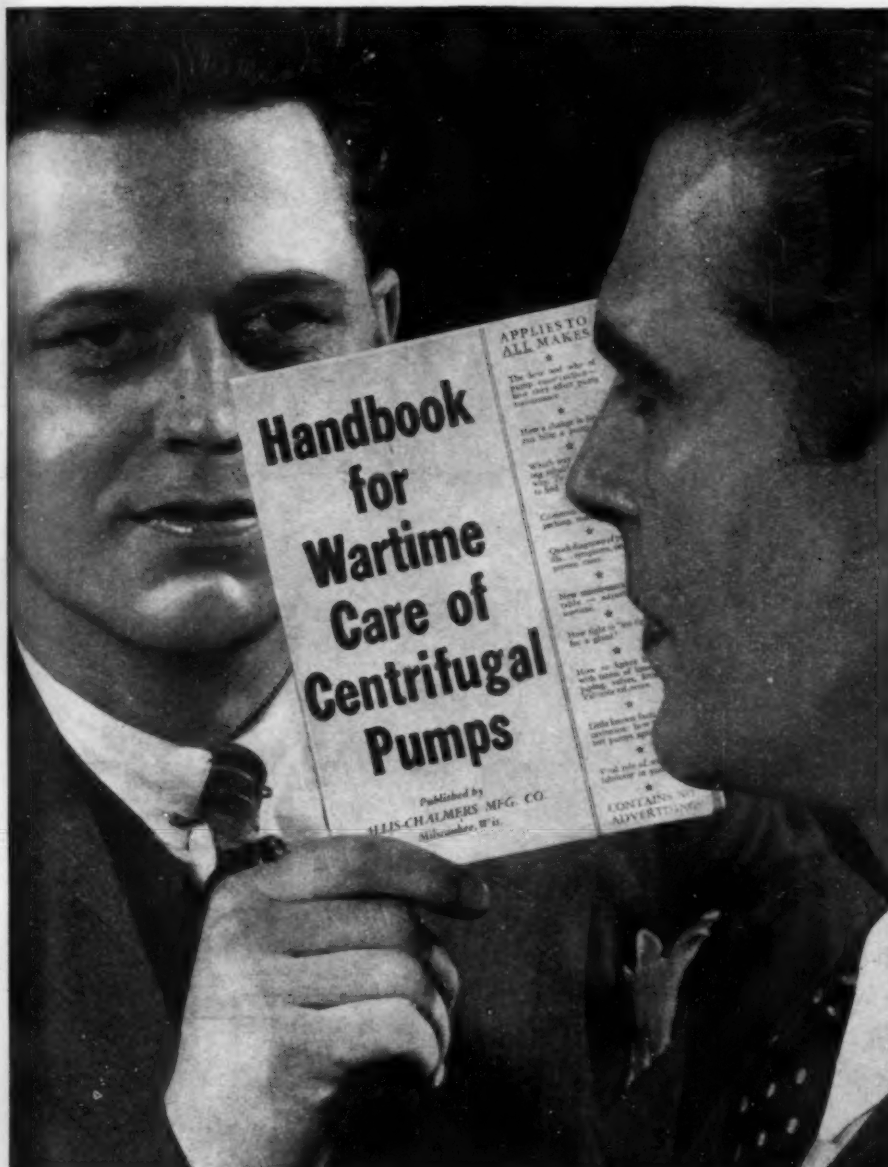
Cash Standard Type 11 Regulator, for use with water, air or any gas or oil that is non-corrosive. Pressure to actuate pilot valve may come from any source and be as high as 1500 lbs. Inlet pressure up to 600 lbs.; outlet pressure up to 250 lbs. Sizes: 2" to 12".



Type 8871 Pressure Reducing Valve; for use with liquids—especially dirty liquids, like Bunker C fuel oil for example. No sliding fits; inner valve bolted to diaphragm for positive movement. Initial pressure up to 250 lbs.; reduced pressure up to 200 lbs. Bodies: iron, bronze or steel. Renewable inner valve and seat ring, stainless steel. Sizes: 1/2", 3/4", 1"

☆

Pump Book Makes News!



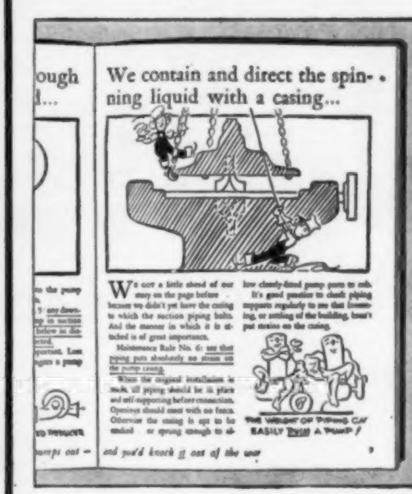
Contains no advertising— applies to all makes — copies mailed free of charge. Use it to make present pumps last. And when you *do* need new pumps, look into the extra efficiency, ruggedness and long life of Allis-Chalmers centrifugal pumps — the famous "Electrifugal" . . . and all types for every purpose.

ALLIS-CHALMERS MILWAUKEE

WE WORK FOR VICTORY — WE PLAN FOR PEACE

HOW TO MAKE EQUIPMENT WORKING ROUND THE CLOCK LAST IS INDUSTRY'S MOST DISCUSSED SUBJECT. MOST DISCUSSED BOOK IS A-C'S NEW PUMP MAINTENANCE GUIDE!

Now that pumps are working 2 and 3 times as many hours a week as in peacetime, *they need wartime care* . . . the kind set forth in Allis-Chalmers new "Handbook for Wartime Care of Centrifugal Pumps"!



By building a pump on paper, this new handbook takes a *fresh* look at pump anatomy. Contents include new preventive maintenance tips, a guide to spotting trouble, a new *war* timetable for pump care, valuable tables. Tear out the coupon below and send in now for *your* free copy!

ALLIS-CHALMERS MFG. CO.
Milwaukee, Wisconsin

Gentlemen:

Yes, I would like to receive *free of charge* a copy of your "Handbook for Wartime Care of Centrifugal Pumps".

(Name)

(Title)

(Company)

(Street Address)

(City and State)

A-1582—2

1939 . . . 2,500 tons — 1943 . . . 500,000 tons

These figures are staggering, and if the Axis War Lords have heard of them they must be staggered, too. Only a strong, vigorous nation like the United States, endowed with a wealth of raw materials—and a free, enthusiastic people—could undertake such a program and carry it to a successful conclusion.

The heavy responsibility for meeting this demand for more and more synthetic rubber, rests primarily with the manufacturers of refinery equipment. With typical American ingenuity and energy, they have shouldered the task. Truly, only the U. S. could do it.

**BUY BONDS AND THE U. S. A.
WILL KEEP ON DOING IT**

TA-1249

BABCOCK & WILCOX TUBES

HOT FINISHED COLD DRAWN ALLOY STEELS CARBON STEELS

THE BABCOCK & WILCOX TUBE COMPANY, BEAVER FALLS, PA.

CHECK WITH LINK-BELT ON FOOD DEHYDRATION

Typical Food Products Processed in a Link-Belt Roto-Louvre Dehydrator:

Carrots	Beans	Cheese, grated	Spices
Sweet potatoes	Bran	Citrus fruit refuse	Sugar
Apples	Bread crumbs	Cotton seed	Sugar beet pulp
Wheat Germ	Bread, sliced	Hominy	Salt
White potatoes	Casein	Malts	Starches
Beef	Cereals	Maize	Soy beans
Pork	Cocoa beans	Molasses feed	Rice
Chicken	Cocoa nibs	Nuts	Rye
Codfish	Coffee beans	Oats	Tea
Almonds	Corn germ	Peanuts	Tobacco
Apple pomace	Corn	Peas	Wheat
Barley	Copra		

● The Link-Belt Roto-Louvre Dehydrator is the efficient, economical unit for dehydrating food products, meat and vegetables.

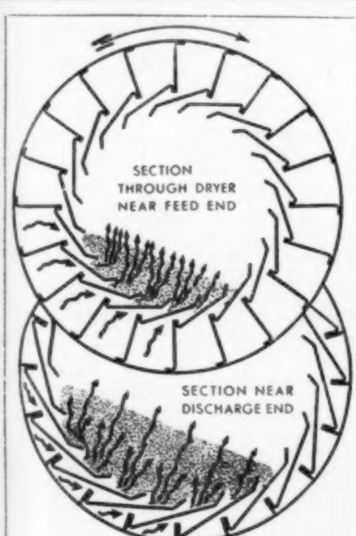
Gentle handling, low temperatures, and uniformity of each particle dried, are keynotes for success in dehydration. These features are all embodied in a Link-Belt dehydration plant.

Let us make your present or proposed dehydration plant a producer of quality products on a volume basis.

LINK-BELT COMPANY

Chicago, Indianapolis, Philadelphia, Atlanta, Dallas, San Francisco, Toronto. Offices in principal cities.

9102-A



Thermal input is controlled to suit drying needs

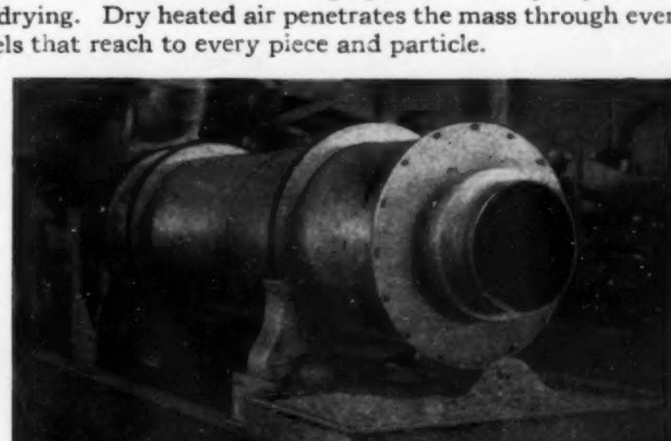
A large volume of dry hot air easily penetrates the relatively thin bed of material near the feed end of the dryer for maximum heat transfer where greatest evaporation can take place. As the material moves forward the bed becomes thicker and the air passages get smaller so that a reduced volume of heated air will penetrate the bed—thus preventing overheating.

A uniform treatment . . . a uniform product

The Roto-Louvre principle of aerated mass-drying produces uniform results because all of the material is treated in the same way at the same time. There can be no stratification or segregation—no "spotty" overdrying or underdrying. Dry heated air penetrates the mass through ever-changing channels that reach to every piece and particle.

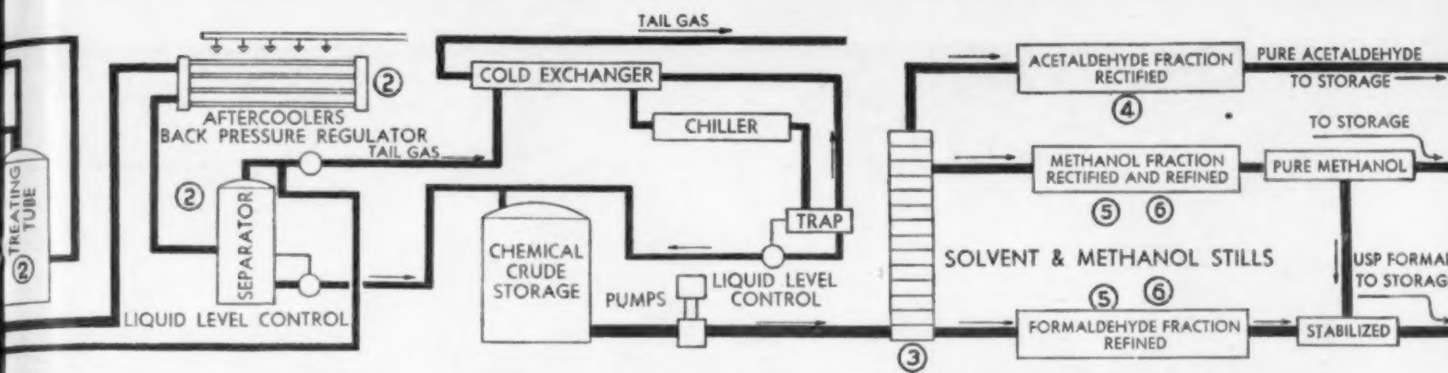
Gradual positive heat transfer

The Roto-Louvre principle greatly lessens the tendency of materials to case harden without sacrificing thermal efficiency or slowing up output. This is accomplished by the initial rapid drying and slower further drying in relatively moist air which occurs in the mass material bed of all of these units.



Roto-Louvre Dryer Dehydrating Vegetables

LINK-BELT ROTO-LOUVRE DEHYDRATOR



E *and* METHANOL . . .

C-B COMPRESSORS ARE VETERANS IN SYNTHESIS WORK

Another pair of vital synthetics — from natural gas . . . and from Cooper-Bessemer compressors — formaldehyde, to produce formalin for plastics, and methanol, important ingredient of anti-freeze.

Cities Service Oil Company pioneered in producing these and allied compounds at their Tallant, Oklahoma plant — built in 1928, and C-B equipped! Today those sturdy Cooper-Bessemer horizontals are still on the job . . . still meeting that first essential — continuous low-cost operation. That's dependability!

Most modern type compressor is the G-MV — rugged . . . reliable . . . powerful — with a compact V-angle gas engine. Uniform flow rates, torque, and pressures are maintained by Cooper-Bessemer's unique automatic control. The G-MV is built to handle any gas. It is ideal for synthesis work and is available for early shipment.

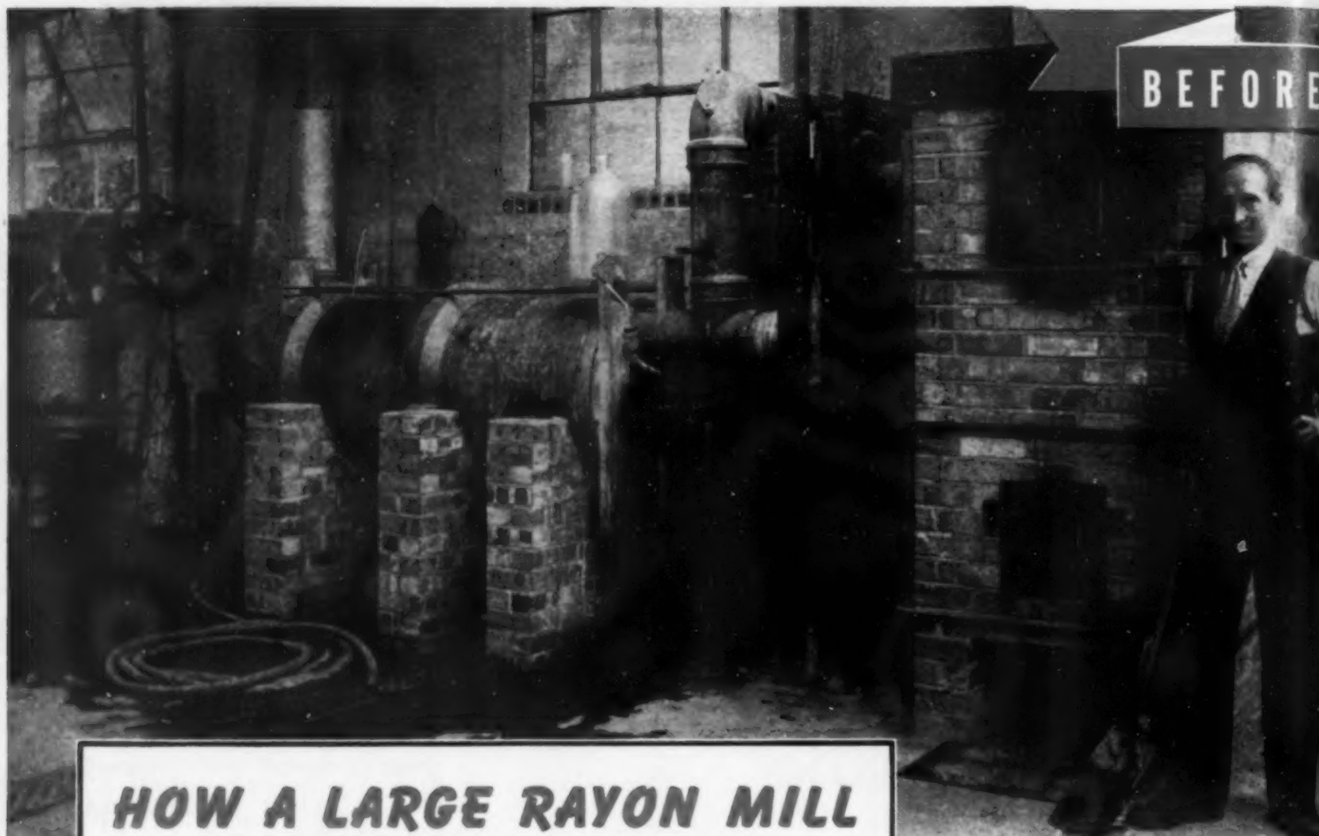
At Left — G-MV's of the type recently installed in one of Cities Service Company's plants. G-MV's are now built in four sizes—400, 600, 800 and 1000 hp. They develop working pressures required for any process, high or low.

COOPER BESSEMER EST. 1833

r *by* Cooper-Bessemer

MOUNT VERNON, OHIO AND GROVE CITY, PENNA.

Houston, Dallas, Greggton, Pampa and Odessa, Texas   Tulsa   Shreveport   St. Louis   Los Angeles   Seattle, Wash.



HOW A LARGE RAYON MILL REDUCED OPERATING COSTS THROUGH SWENSON COOPERATION

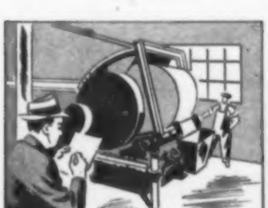
Above is shown the directly heated tile chamber which served as the spin bath evaporator for a large rayon mill. Its high temperature operation was characterized by excessive fuel consumption, extreme corrosion, frequent shutdowns, and expensive maintenance.

The cooperation of Swenson engineers resulted in the design and fabrication of the cast antimonial lead evaporators shown on the opposite page—equipment that operates at a lower temperature from a partial vacuum.

Reduced corrosion and savings in fuel are making the new equipment far more economical to operate.

Swenson engineers are ready to cooperate wherever there are problems in evaporation, filtration, or crystallization. Their years of specialization in this field give them an unequalled background of experience . . . on which thousands of highly successful installations have been based. Send a letter outlining your problems. Swenson Evaporator Company, Division of Whiting Corporation, 15669 Lathrop Ave., Harvey, Illinois.

ONLY SWENSON PROVIDES THIS FIVE-WAY SERVICE

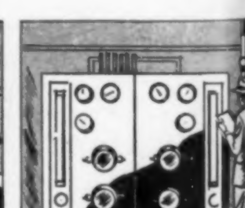


1. Analysis of Requirements

2. Design and Layout

3. Manufacture of Equipment

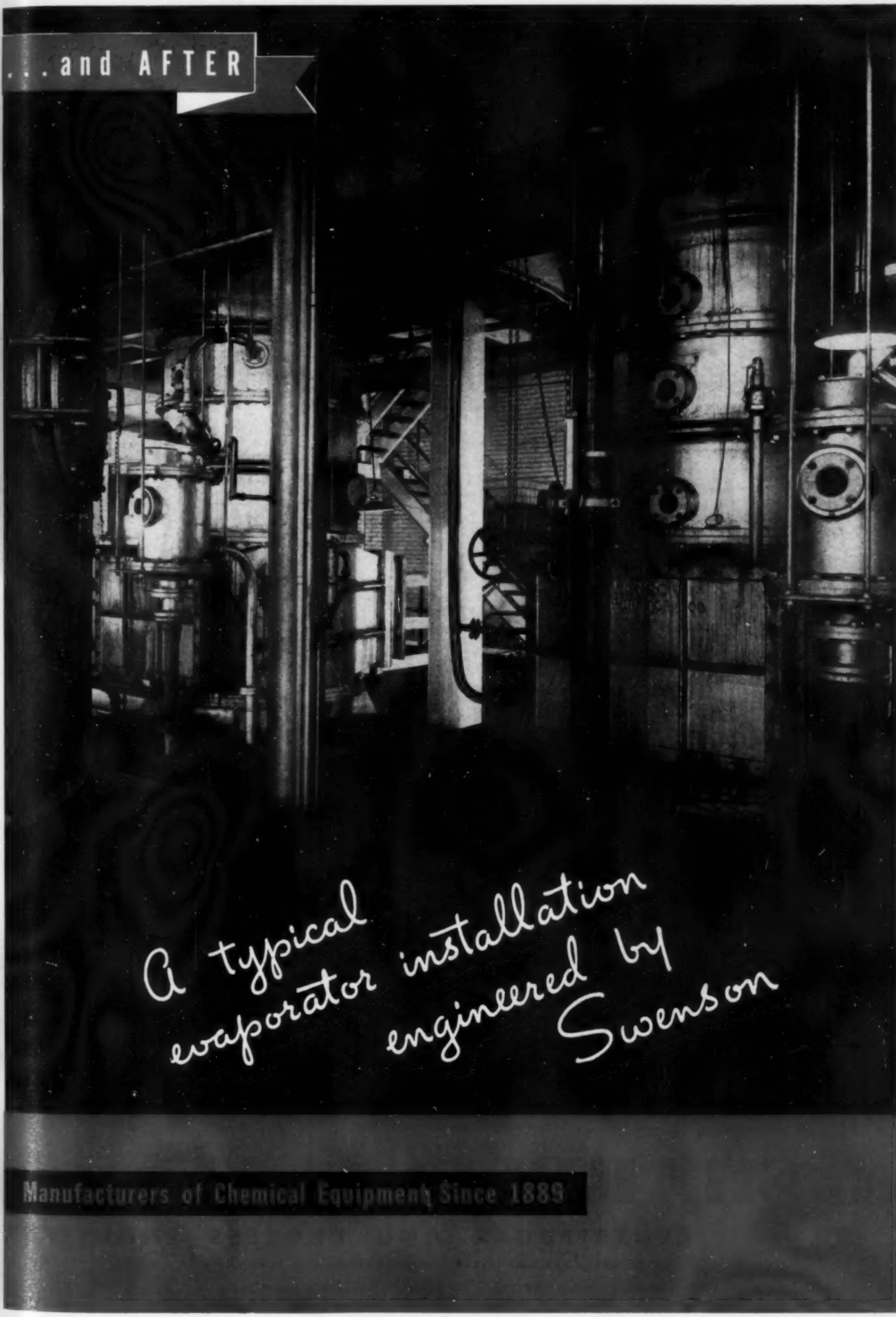
4. Test Operation



5. Periodic Check-ups

SWENSON

EVAPORATORS • FILTERS • CRYSTALLIZERS


. . . and AFTER
A typical
evaporator installation
engineered by
Swenson
Manufacturers of Chemical Equipment Since 1889

ADVERTISEMENT—*This entire page is a paid advertisement.* *Prepared Monthly by U. S. Industrial Chemicals, Inc.*

U.S.I. CHEMICAL NEWS

June ★ A Monthly Series for Chemists and Executives of the Solvents and Chemical Consuming Industries ★ 1943

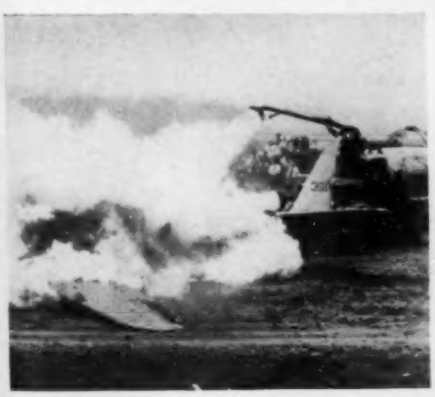
Indalone Available To Companies Having High Priority Ratings

Insect-Repellent Is Now Obtainable from U.S.I.

Quantities of Indalone, an insect-repellent outstanding for its slow-evaporating and film-forming characteristics, are now available from U.S.I. to companies having high priority ratings.

Virtually odorless and non-greasy, Indalone owes its repellency to its bitter taste and its effect on the nerve endings in the feet of insects. Of particular interest today is the ability of Indalone to repel effectively such insects as biting flies, mosquitoes, chiggers and other insects.

Additional information on the properties and uses of Indalone will be gladly furnished by U.S.I. on request.



To save lives of crashed pilots, a truck has been developed which smothers the flames of a burning plane in less than three minutes with thousands of pounds of carbonic acid ("DRY-ICE"*). Streams of CO_2 are sprayed from the main boom nozzle and from two bumper outlets in front of the tires.

* Pure Carbonic, Incorporated, sells "DRY-ICE" manufactured by U.S.I.

Methoxyl, Ethoxyl Groups Determined by New Method

MONTREAL, Canada — What is claimed to be a simpler and more accurate method for the simultaneous determination of methoxyl and ethoxyl groups has been developed by two research workers here.

The difficulty normally encountered in completely removing crystalline tetramethyl salt is said to have been overcome by washing out the absorption tubes with a small quantity of water followed by stock 97% ethanol. This innovation is reported to have also obviated the necessity for using an absolute ethanol solution of trimethylamine.

The difficulty in isolating the ethyl iodide quantitatively, encountered in present methods for a combined methoxyl-ethoxyl determination, is said to have been overcome by first determining total alkoxyl according to the standard Vieböck-modified Zeisel procedure, then determining the methoxyl content alone according to a modified Wilstätter procedure.

Ethyl Acetoacetate Plays Vital Role In Anti-Malarials, Vitamin B_1

U.S.I. Intermediate Used in Synthesis of Quinacrine Hydrochloride, Plasmoquin and Thiamin Hydrochloride

Ethyl acetoacetate, which has heretofore found principal use in the manufacture of the pyrazolone and Hansa Yellow pigments, has now assumed a vital role in the production of the strategic products, Quinacrine hydrochloride (Atebrin), Plasmoquin, and Thiamin hydrochloride (Vitamin B_1). These three products are playing a very important part in the war and will undoubtedly be extremely valuable in the peace to follow. In addition, ethyl acetoacetate can be used in the synthesis of the essential amino acids. In all of these syntheses, the ethyl acetoacetate is first converted to the sodium salt with sodium ethoxide.

Used as Substitutes

Quinacrine and Plasmoquin are the synthetic anti-malarials which are being substituted for the unobtainable quinine and other alkaloids usually imported from the Dutch East Indies. Quinacrine and Plasmoquin have the same side chain, 4-amino-1-diethyl amino pentane, attached to 3-chloro-7-methoxy-acridone and methoxy-quinoline respectively. It is in the preparation of this side chain that the ethyl sodium acetoacetate is used. This synthesis is represented by the first three reactions in the box below.

In the synthesis of thiamin, ethyl sodium acetoacetate is reacted with ethylene oxide to give alpha acetyl gamma butyro lactone. From the alpha acetyl butyro lactone, either 4-methyl, 5-beta-hydroxyethyl thiazole or 2-methyl-2-ethoxy-3-chloro tetra-hydro furane is prepared which are condensed with 2-methyl-4-amino-5-halogeno methyl pyrimidine and 2-methyl-4-amino-5-thioformylamino methyl pyrimidine respectively to give vitamin B_1. The commercial production of thiamin is now well established and indications are that the volume will be substantially increased in the months to come.

Amino Acids

Several investigations have shown that there are ten amino acids which are essential for human and animal life. With the projected nutrition programs, these amino acids should become of increasing importance. Starting with ethyl sodium acetoacetate, it is indicated that these amino acids can be made according to the fourth reaction in the box below.

(*Continued on next page*)

Advise Low Temperature Crystallization Oil Analysis

MADISON, Wis. — Speed and applicability to small samples are among the advantages claimed by three research workers here for the use of low temperature crystallization from acetone solution as a method of determining the saturated fatty acids in glycerides.

The fatty acids are dissolved in dried, redistilled acetone in a 50 cc. centrifuge tube which is then immersed in a low temperature alcohol bath. The temperature is lowered to —40°C. by the addition of solid carbon dioxide. After standing 15 to 20 minutes the tube is placed in a metal centrifuge tube cooled to the same temperature and centrifuged briefly to throw out the crystalline saturated acids. The supernatant solution is then transferred to a weighed tube. Acetone at —40°C. is blown from a pipette into the tube containing the saturated acids and the tube rotated rapidly to wash the precipitate.

Preparation of Membranes for Ultrafilter in Tanning Studies

CINCINNATI, Ohio — A new method for the preparation of membranes to be used in ultrafiltration in tanning research, that differs principally from other procedures in the evaporation of solvents and in the mechanics of calibration, was recently revealed by a chemist here.

In the preparation of membranes by this method, a portion of the solvents is evaporated from a collodion solution with the resultant formation of a gel.

A stock solution of the following composition is recommended:

Parlodion (Mallinckrodt)	150 gm.
Absolute ethanol	316 ml.
Absolute ethyl ether	1043 ml.
Acetone	1453 ml.
Amyl alcohol	575 ml.

Ethyl Sodium Acetoacetate Used in Preparing Quinacrine and Plasmoquin Side Chains

$$(C_2H_5)_2NC_2H_4OH + HCl \longrightarrow (C_2H_5)_2NC_2H_4Cl + H_2O$$

$$(C_2H_5)_2NC_2H_4Cl + CH_3C(ONa){:}CHCOOC_2H_5 \longrightarrow CH_3CO\underset{\displaystyle CH_2CH_2N(C_2H_5)_2}{\underset{|}{CH}}COOC_2H_5$$

$$\xrightarrow[\text{Decarboxylate}]{H_2O} CH_3COCH_2CH_2CH_2N(C_2H_5)_2$$

$$CH_3COCH_2CH_2CH_2N(C_2H_5)_2 + NH_3 \xrightarrow{H_2} CH_3CHNH_2CH_2CH_2CH_2N(C_2H_5)_2$$

Amino Acids Made With Ethyl Sodium Acetoacetate

$$CH_3C(ONa){:}CHCOOC_2H_5 \xrightarrow{RCl} CH_3COCHRCOOC_2H_5 \xrightarrow{C_4H_9ONO + H_2SO_4}$$

$$RC{:}(NOH)COOH \xrightarrow{H_2} RC(NH_2)HCOOH$$

June ★ U.S.I. CHEMICAL NEWS ★ 1943

Ethyl Acetoacetate Uses

(Continued from preceding page)

Important Properties

The reactions given are typical of the wide variety obtainable with ethyl acetoacetate which lead to an extended list of valuable products. The two properties which make it important in chemical synthesis are:

1. The reactivity of the hydrogen on the carbon adjacent to the $COOC_2H_5$ group. Hydrogen substitutions at this point lead to the introduction of groups such as halogen, metal, acyl and alkyl radials. Ammonia, aniline, urea and many other types of compounds containing the NH_2 group, add with the elimination of water.

2. The addition products (especially the amides) mentioned above have a tendency to close into ring structures of the most varied types, giving for example substituted pyrroles, pyrazoles, pyrazolones, pyrimidines, pyridines, quinolines, isoxazoles, furane and coumarin derivatives.

Crystallized Heart Stimulants Obtained by Simplified Method

NEPERA PARK, N. Y.—A patent has been assigned to a company here for what is claimed to be a simpler, better method of obtaining crystallized heart stimulants both from the amorphous products and directly from the crude extract of the raw material.

According to the invention, glucosides in crystallized form may be obtained from their solutions in organic solvents, or in a mixture of such solvents with water, by having same adsorbed on hydroxides of polyvalent metals, and afterwards fractionating and eluting from the adsorbing material. It is claimed that the pure products may be obtained from the eluates by evaporation, salting out or by precipitation.

Typical Procedure

Following is a typical example of the procedure: 5 grams of crude glycosides obtained from *Digitalis purpurea* are dissolved in a mixture of 80 cc. ethanol and 20 cc. acetone. To this solution, under shaking, first 10 cc. water is added and then a suspension of aluminum hydroxide (equivalent to 8 grams aluminum oxide) in 150 cc. of ethanol. The adsorbent is collected and eluted with pyridine. The pyridine solution is then concentrated to a small volume in vacuum and diluted with ethanol. On careful addition of water digitoxin is said to crystallize out.

Method for Spot Testing In Solvent Extractions

IVORYDALE, Ohio—A simple spot test for determining the completeness of extraction of fatty oils or other nonvolatile liquids with volatile solvents, has been evolved by a chemist here with the use of ground glass.

Drops of the solution under test and of the solvent are placed on a clean ground glass to evaporate. Depending on the amount of solute present, the transparencies formed are said to vary from that of the clean plate with the pure solvent to a disk of clear transparency of about the same area as that of the spot before evaporation. A wide variety of intensities lies between these extremes. At low concentrations of solute, one or more circular lines of approximately hairline thickness are formed. The residue can also be viewed against a dark background. The black test may show a slight hairline transparency of varying intensity when the solvent is impure.

The limit of sensitivity of the test described is about one part of solute in 20,000 parts of solvent. By allowing two or more drops of solution to evaporate on the same spot, or by dusting the spots with a dark powder, greater sensitivity can be obtained.

Paba Ester Is Utilized In New Thiamin Assay

CHICAGO, Ill.—A new thiamin assay has been developed by two professors here, based on the pink to red coloration formed when thiamin is reacted with diazotized ethyl *p*-aminobenzoate. The thiamin does not have to be absorbed prior to the application of the test.

In applying the new method, the colored compound resulting from the reaction of diazotized ethyl *p*-aminobenzoate and thiamin is extracted with isoamyl alcohol and the extract compared with a series of standards using a Pulfrich photometer. It is reported that maximum color is produced within two minutes and is stable for at least three months. Solutions containing as little as three to six gammas per five cc. of solution can be tested.

New Fungicide, Deodorant

ORADELL, N. J.—A patent has been awarded to an inventor here for a combination fungicide and deodorant which is composed of approximately one part of cadmium chloride, one part of sodium dioctylsulfosuccinate, and 98 parts of 30% ethyl alcohol.

TECHNICAL DEVELOPMENTS

Further information on these items may be obtained by writing to U.S.I.

A cleaner for plastic glass is announced which is said to emulsify grease and engine spatter. Among the claims made for this product are that it is non-toxic and safe on paint or hands, that it is free-rinsing, thus leaving no grease on the surface, and that it does not cause "crazing" or infinitesimal scratches. (No. 700)

U S I

A chemurgic rubber has been developed for use where service requirements are not too high. The maker claims it may be used independently or as an extender blended with natural, reclaim or synthetic rubber. Water, alcohol and lubricating oils are said to have no apparent effect on this product nor antioxidants upon accelerated aging tests. Its reactions to solvents and chemicals are generally similar to that of rubber. (No. 701)

U S I

A methyl salicylate substitute is offered for technical purposes only, not for food stuffs. (No. 702)

U S I

Dust masks and caps have been developed from a vegetable fibre product which the maker says may be stitched, washed and ironed. (No. 703)

U S I

An adhesive is announced for bonding a wide variety of products to themselves as well as to such other surfaces as cork, glass, rubber, leather, paper, fiberboard, and wood. Drying time on porous surfaces is said to be about 20 minutes, on non-porous surfaces somewhat longer. The bond is claimed to develop early strength and have high initial tack. (No. 704)

U S I

A hand cleaner is announced for the removal of paint, grease, grime, ink and other stains. The maker says it can be used without scrubbing and without soap or water. It is claimed to contain no grit or pumice stone. (No. 705)

U S I

A compound of reclaim rubber emulsion has been developed which is said to save 40% of the reclaim by substitution, to afford combining strength to cloth closely approaching that of latex, and to impart resistance to weakening in the presence of water far superior to the reclaim rubber itself. This compound is expected to find wide application where reclaim rubber and latex have been used as adhesives or coatings. (No. 706)

U S I

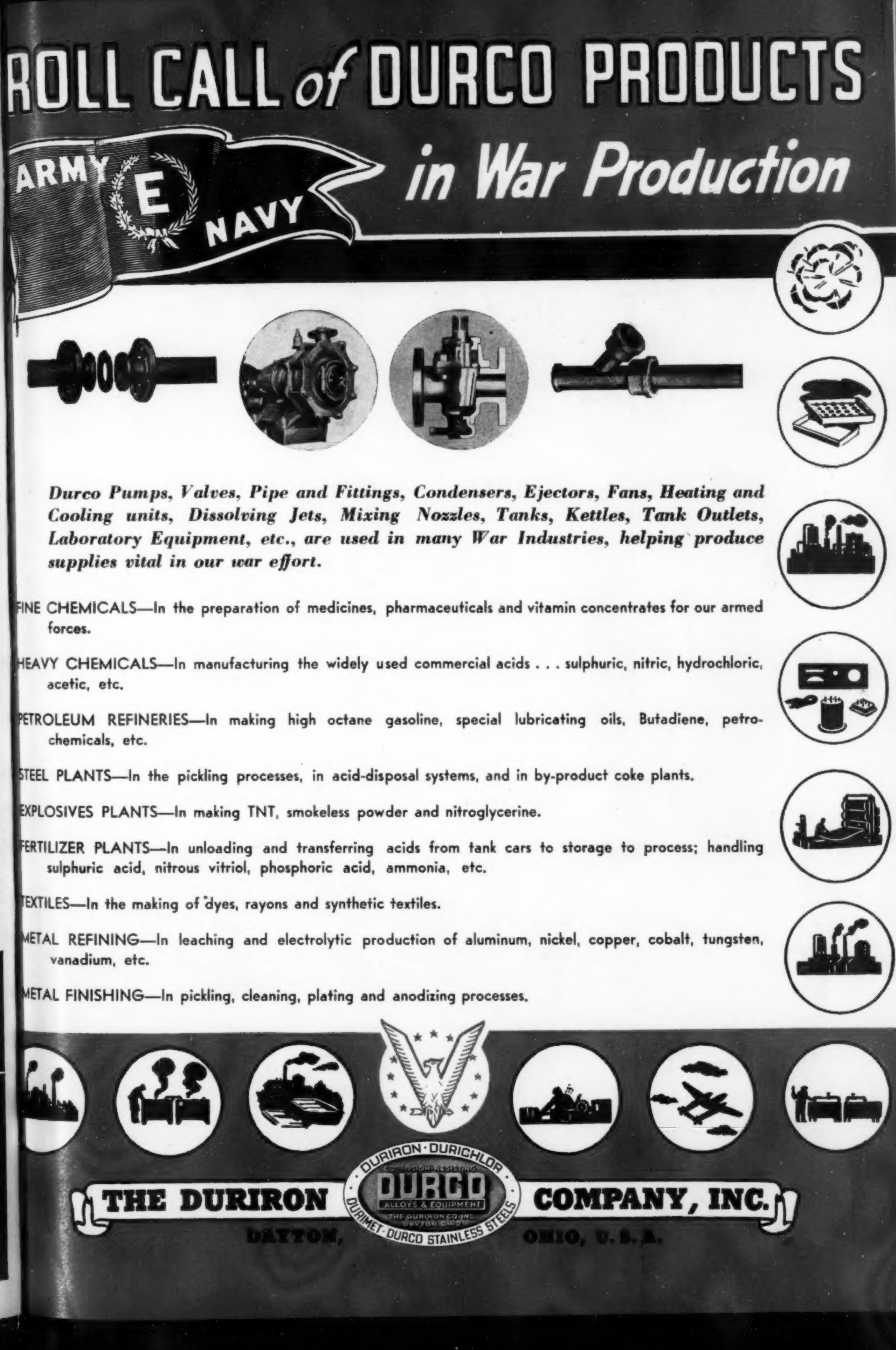
A dehydrated glue is offered in crystal and powder form which is said to decrease shipping bulk and improve final working qualities. (No. 707)

U S I

A liquid material for floors is announced which is claimed to produce a non-slip, wear-resisting surface that protects metal from corrosion and wood from moisture. This surface is also said to be resistant to the action of oil, grease, gasoline, salt, sulphur and cleaning materials. (No. 708)

U S I

Improved concrete dispersion is claimed for a new liquid put on the market. Added to a concrete mix in the proportion of 1 qt. per bag of Portland cement, it is said to reduce the amount of water used by 80%, improve workability of the mix, and increase compressive strength. (No. 709)


ROLL CALL of DURCO PRODUCTS
ARMY E NAVY
in War Production
Durco Pumps, Valves, Pipe and Fittings, Condensers, Ejectors, Fans, Heating and Cooling units, Dissolving Jets, Mixing Nozzles, Tanks, Kettles, Tank Outlets, Laboratory Equipment, etc., are used in many War Industries, helping produce supplies vital in our war effort.
FINE CHEMICALS—In the preparation of medicines, pharmaceuticals and vitamin concentrates for our armed forces.
HEAVY CHEMICALS—In manufacturing the widely used commercial acids . . . sulphuric, nitric, hydrochloric, acetic, etc.
PETROLEUM REFINERIES—In making high octane gasoline, special lubricating oils, Butadiene, petrochemicals, etc.
STEEL PLANTS—In the pickling processes, in acid-disposal systems, and in by-product coke plants.
EXPLOSIVES PLANTS—In making TNT, smokeless powder and nitroglycerine.
FERTILIZER PLANTS—In unloading and transferring acids from tank cars to storage to process; handling sulphuric acid, nitrous vitriol, phosphoric acid, ammonia, etc.
TEXTILES—In the making of dyes, rayons and synthetic textiles.
METAL REFINING—In leaching and electrolytic production of aluminum, nickel, copper, cobalt, tungsten, vanadium, etc.
METAL FINISHING—In pickling, cleaning, plating and anodizing processes.
DURIRON · DURICHLOR
CORROSION-RESISTING
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THE DURIRON COMPANY, INC.
DAYTON, OHIO, U. S. A.

VERTICAL, HOLLOW-SHAFT INDUCTION MOTOR

Another G-E "first" for hazardous service

Here's a motor that provides extra security in the important wartime task of pumping aviation gasoline from underground storage tanks. It is ideally applicable to high-capacity, deep-well turbine pumps, wherever hazardous fluids like gasoline are being handled.

Included as an integral part of the motor is a nonreverse ratchet which prevents the possibility of reverse rotation and consequent damage to the pump. This ratchet is built of nonsparking parts—an important explosion-proof feature.

Whatever your need for motors for hazardous service, you'll find your best chance for meeting it in the G-E line of "U-L listed" motors. Also, G.E. will help you select and apply them, and see that they reach you as promptly as your priority status permits. Just call your local G-E Representative. *General Electric Company, Schenectady, N. Y.*

UNDERWRITERS LABORATORIES LISTED FOR CLASS I, GROUP D, LOCATIONS

G-E vertical motors in hollow-shaft types are well-protected inside and out. Built in a full range of sizes. Also available with solid shaft.

TWO OTHER G-E "FIRSTS"

G-E EXPLOSION-PROOF SQUIRREL-CAGE MOTORS

Now listed up to 600 hp by Underwriters Laboratories, Inc., for Class I, Group D, locations—where atmospheres may contain gasoline, petroleum vapors, natural gas, and the like.

G-E WOUND-ROTOR MOTORS

In explosion-proof construction up to 600 hp. Provide flexible speed for drives in hazardous Class I, Group D, locations.

BUILDER OF TRI/CLAD MOTORS

GENERAL ELECTRIC

750-209-8030

We Made a Mole Hill Out of a Mountain

Bigelow-Liptak engineering and construction methods solved the problem of directing large volumes of acid-laden, low temperature gases from a series of process furnaces to an exhaust chimney.

THE PROBLEM that faced one of the country's largest copper smelters was a tough one. A satisfactory and economical means had to be developed and constructed for carrying off large volumes of acid-laden gases from process furnaces to a chimney.

Due to the enormous volume of gases being released, any flue for handling them would necessarily involve large exposed areas. Such a flue, necessary for directing the gases, would have to be designed for maximum wind load and made weather proof. Also it would have to be air-tight to maintain a relatively high draft or negative pressure.

In order to sustain a temperature high enough at the base of the stack to create the necessary draft, a method for assuring a reasonably low conduction heat loss for the entire flue had to be worked out.

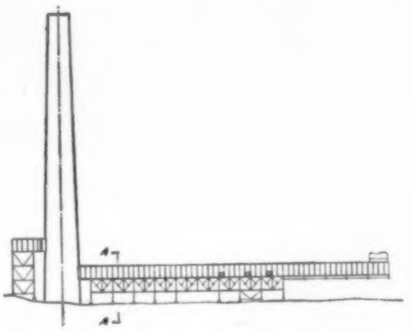
Another factor added to the problem. Adequate provisions had to be made for taking care of the great amount of thermal expansion that would naturally occur in a flue of this length. In designing the flue, means of compensating for this expansion would have to be incorporated in the design.

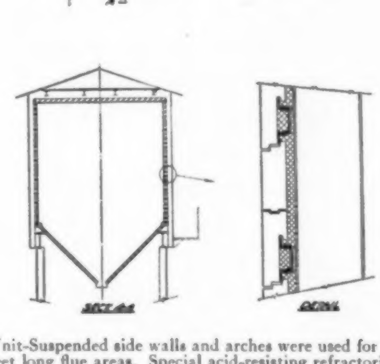
As should be the case, costs had to be an important consideration. Any passage devised would have definite price limitations and the design had to be economical.

The Solution

Bigelow-Liptak engineers visited the job. A complete survey of the problem and all its factors was made and studied. Preliminary drawings for the general design of a flue were made right at the job site. Later, back in the general office complete and detailed drawings were developed and studied by the Bigelow-Liptak engineering staff. A thorough analysis was made of the thermo-dynamics, the mechanics of materials and the ceramics.

As a result of this careful analysis and study, a thoroughly satisfactory and economical means was worked out for directing the acid-laden gases from the furnaces to an exhaust chimney. Recommendations were prepared and cross section drawings of the entire flue — as shown — were submitted.





Unit-Suspended side walls and arches were used for the 350 feet long flue areas. Special acid-resisting refractories were selected. Because of experience, Bigelow-Liptak knew that this type of acid-resisting tile should be manufactured on extrusion machines. This was important in designing the tile, as all special shapes would have to be designed to conform to this process without sacrificing any of the advantages of Unit-Suspended construction. Air tightness and low heat conduction losses, being a natural feature of Bigelow-Liptak Unit-Suspended construction, were easily incorporated into the design, once the major problem had been solved.

Bigelow-Liptak's exclusive designs made possible an uninterrupted weather proof insulation shield or encasement —thereby eliminating the need of critical steel plate—a factor of considerable importance today.

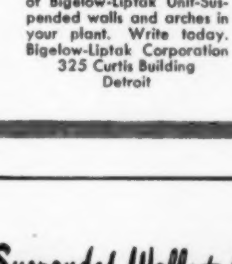
Because of the acid in the gases, ordinary expansion joints could not be used to provide for the expansion and contraction. A special fibre glass had to be employed.

By applying Bigelow-Liptak engineering skill and principles, the problem of finding a satisfactory means of transferring acid-laden gases to an exhaust chimney, was solved

What This Means To You

The significance of this problem and its complete solution by Bigelow-Liptak is much greater than any resemblance it may have to any of your problems. It serves to demonstrate the value you may receive by taking your problems to Bigelow-Liptak regardless of their type or size. Bigelow-Liptak's wide experience in designing enclosures includes every type of problem having to do with thermo-dynamics, ceramics and mechanics of materials. With Bigelow-Liptak there is no standard or set solution for every case. Individualized engineering, based on years of experience and sound engineering principles, is applied towards giving the customer the best and most economical solution to his particular needs. Our policy is to give first and foremost consideration to the needs of the user.

Engineering Information No Obligation



Our engineering staff will be glad to send you interesting catalogs or tell you how you could secure increased service and economy by the use of Bigelow-Liptak Unit-Suspended walls and arches in your plant. Write today. Bigelow-Liptak Corporation 325 Curtis Building Detroit

BIGELOW LIPTAK Corporation

Unit-Suspended Walls + Arches

The Key to Operating Economy

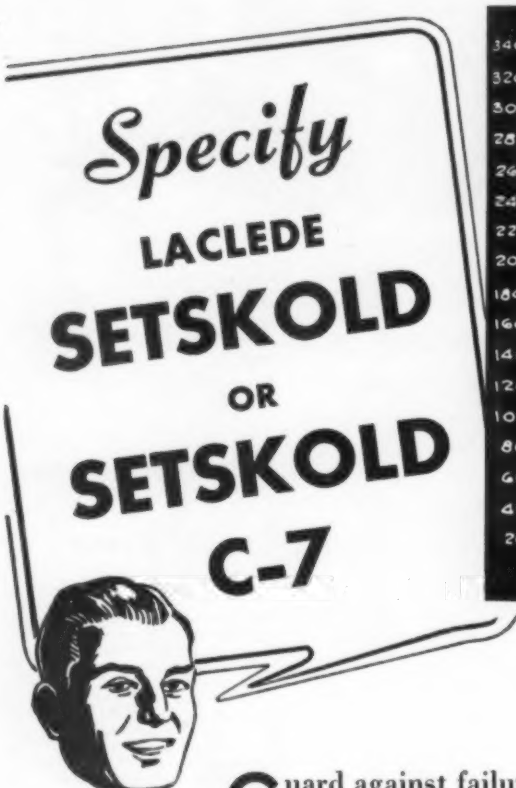
BIGELOW-LIPTAK CORPORATION

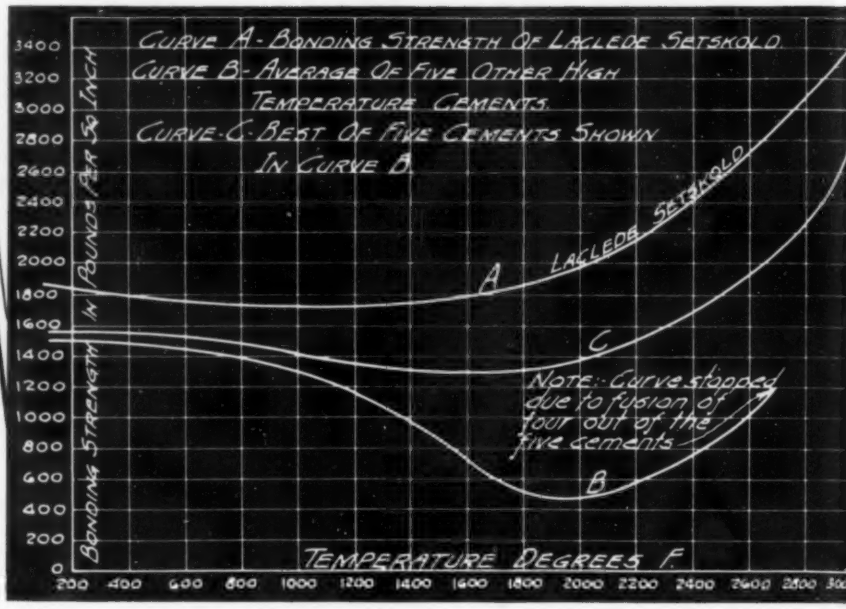
DIVISION A. P. GREEN FIRE BRICK CO.

325 Curtis Building

DETROIT

When You Need a Refractory Bonding Mortar With MAXIMUM BONDING STRENGTH





Facts illustrated by graph clearly and accurately reveal result of tests on five brands of refractory cements as compared with Setskold.

Guard against failures of refractories due to inferior grades of bonding mortar. For a satisfactory job, the mortar is just as important as the brick, so be sure you select the mortar that is best for your job.

When you want a high temperature bonding cement with a bonding quality that makes a solid rock-like wall — that is uniform and dependable — and is noted for its economy of application, ask for Laclede Setskold (diaspore base cement), or Setskold C-7 (Kyanite base super-cement).

Both of these products are resistant to spalling, erosion, slag, and adhesion. Wipe out these enemies of production and save labor, materials, and time. Why take a chance on failure when you can get Setskold or Setskold C-7 from your local dealer or agent. ***Get his name from your local telephone directory or write direct.***

LACLEDE ENGINEERING SERVICE

When you have a problem involving refractories, call in a Laclede-Christy engineer. Because Laclede-Christy offers a *complete* line of refractories, he will give you an unbiased recommendation — the *right* recommendation for your job. Complete blueprints and estimates will be furnished without cost or obligation.

Write for complete details on Setskold and Setskold C-7.

LACLEDE-CHRISTY FOUNDED 1844 ST. LOUIS, U.S.A.

LACLEDE-CHRISTY
CLAY PRODUCTS COMPANY
Ambassador Bldg., St. Louis, Missouri

World's Largest and Most Diversified Line of High Temperature Refractory Specialties

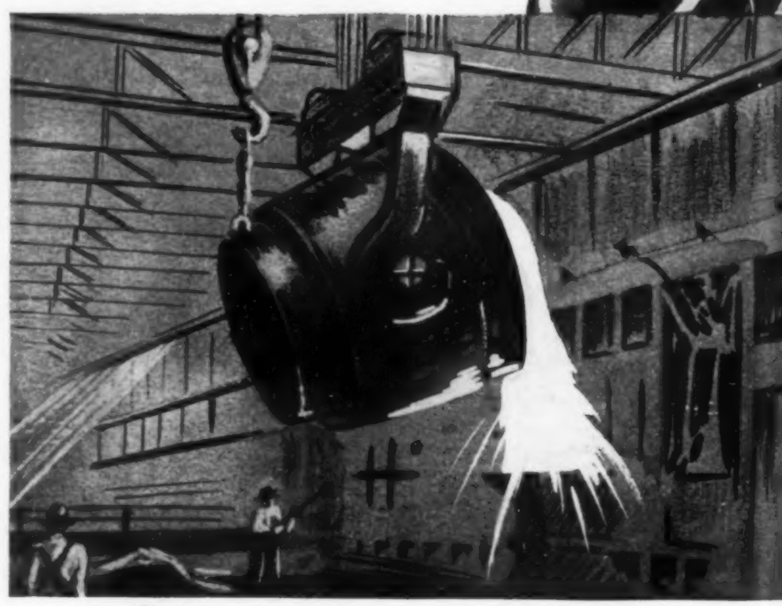
BUBBLING OVER WITH ENERGY—

● The reason for Marblehead's recognized high efficiency in chemical processes, is the power of its high chemical energy, ready for release immediately to do the job in hand.

This store of pent-up energy is the accumulation of centuries of build-up in the extensive Marblehead limestone quarries, where the bones of prehistoric monsters and the shells of tiny fossils have combined to produce limestone of unusually high calcium content.

Manufactured from this choice limestone by modern methods, under strict technical control, Marblehead Chemical Lime brings you this vast fund of pure, high chemical activity to apply to your process—to help turn out more product at less cost—to assure you thorough action—to help maintain your fixed formulae—to prevent delays and interruptions in your production.

In addition, Marblehead possesses valuable *physical* characteristics, even more important in some processes than the chemical qualities—soft, fine texture—of fast or slow-settling nature—quick slaking—freedom from grit.



Used throughout industry, for

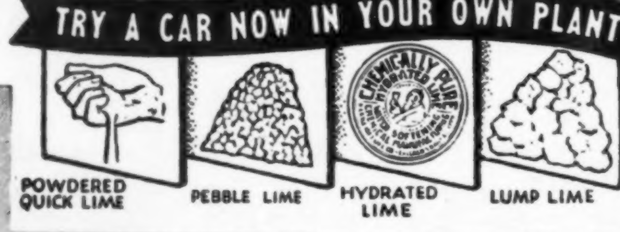
STEELMAKING — PAPER & BOXBOARD — LEATHER — WIRE DRAWING — CHEMICALS — PAINT & VARNISH — BRICKS — FOOD PRODUCTS —WATER TREATMENT — SEWAGE DISPOSAL, ETC.

MARBLEHEAD High Calcium CHEMICAL LIME

Marblehead Chemical Lime i used in open hearth steel ma ufacture as a basic flux to r move acid elements and in purities from the molten ma

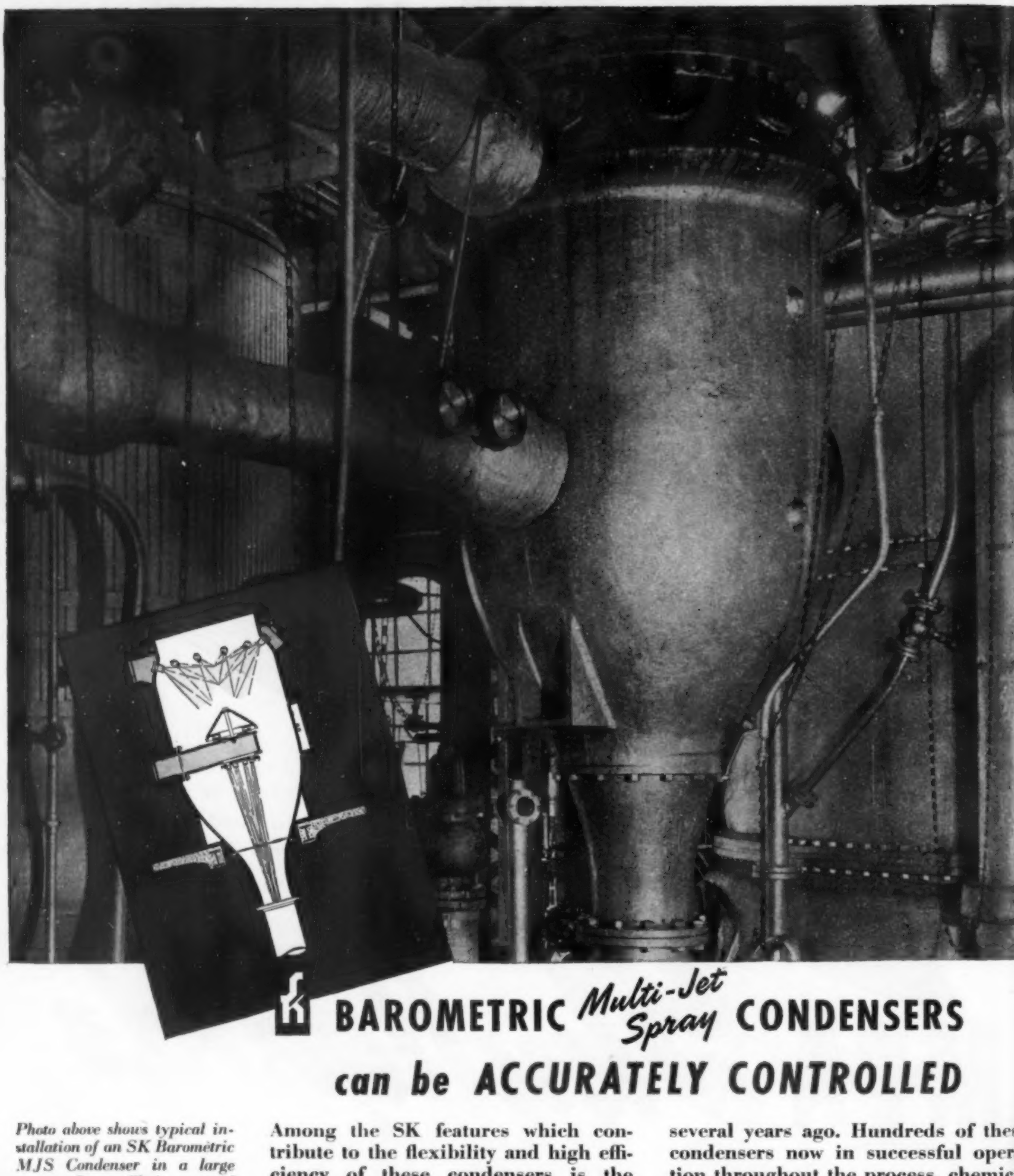
★ FOUR FORMS ★

TRY A CAR NOW IN YOUR OWN PLANT



MARBLEHEAD LIME CO.

160 N. LaSalle St. Chicago, Ill.



FIGHTING FIRE WITH CO_2

Versatile Buell Dust Recovery Systems help produce it

Carbon dioxide, the gas that puts the pop in soda, inflates rubber life rafts, and makes dry ice, is also the gas that snuffs out flaming gasoline and oil. At landing fields and on carrier flight decks, asbestos-clad rescue squads stand by with bright red cylinders of CO_2 to fight crash-landing fires. Planes aloft carry CO_2 to snuff engine fires and prevent gas tank fires caused by tracer bullets.

Versatile Buell Dust Recovery Systems help produce this flame-killer—in many plants as a profitable by-product from flue gases. Buell's function is to clean the gases by removing contaminating flue dust prior to the recovery of the carbon dioxide—a job at which Buell Dust Recovery Systems have proved highly efficient and economical.

The patented van Tongeren cyclone, an exclusive feature, gives Buell Dust Recovery Systems their high efficiency. Long life, low operating and maintenance cost, and unlimited capacity are other reasons for Buell's wide acceptance throughout industry.

Factual 28-page book.
Write for Bulletin G-842.

Memo

CHEMICAL & PROCESS INDUSTRIES

Buell Dust Recovery Systems have many applications for the efficient salvaging of critical materials, such as

Alumina
Magnesium Chloride
Beryllia
Potassium Chloride

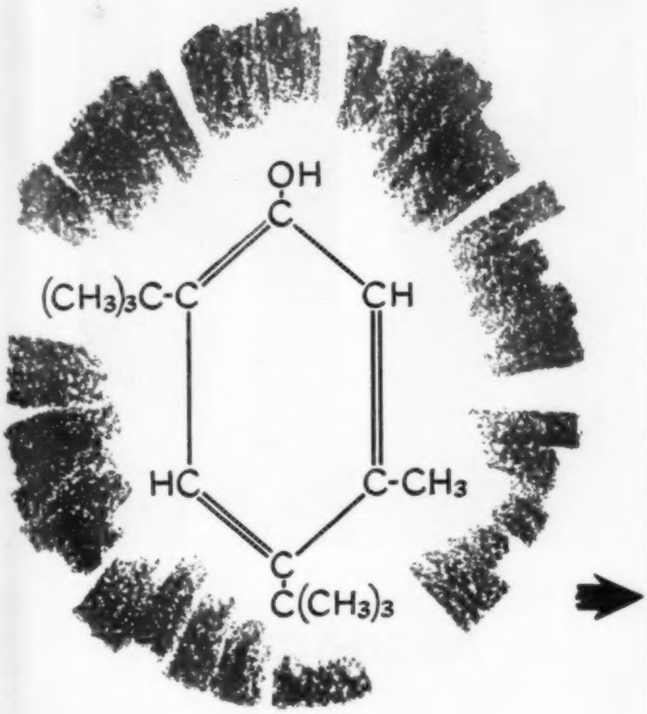
and many others. Buell equipment is also used effectively to clean flue gases to prevent contamination of the finished product, and for the elimination of hazardous dust nuisances.

buell
DUST RECOVERY SYSTEMS

BUELL ENGINEERING COMPANY, INC.
18 Cedar Street, New York
Sales Representatives in Principal Cities

BUY WAR BONDS AND MAKE THE AXIS BITE THE DUST

KOPPERS D. B. M.



4, 6-Di-tertiary-BUTYL-m-CRESOL

Properties: *(Pure Compound)*

Molecular Weight	220
Melting Point	62.5°C.
Boiling Point:	
At 100 mm. (approximate)	171°C.
Atmospheric (approximate)	285°C.
Specific Gravity at 50/50°F.	0.920

State: Light-colored semi-solid, crystalline, mild odor.

Solubility: Practically insoluble in water. Easily soluble in alcohol, benzene, gasoline and carbon tetrachloride. Insoluble in caustic alkali solutions.

Uses: In compounding certain types of synthetic rubber, as a softener and plasticizing agent, and to improve tack. In the manufacture of resins, particularly because of its oil-solubility. It has been suggested for use as an anti-skinning agent for paints and varnishes.

Koppers will be glad to submit samples and prices on this and other coal derivatives, including tar bases, naphthalene, industrial pitches and creosote.

Koppers also supplies to the chemical industry: Coal for steam and for processing. Coke for metallurgical use and for heating. Coal processing systems. Gas plants. Gas purification systems. Gas holders. Valves. Time cycle controls. Anti-corrosive alloys. Fast's self-aligning couplings. Piston rings for compressors, pumps, and steam and diesel engines. Pressure-treated timber for damp and humid locations. Coal tar roofing, waterproofing, dampproofing, industrial pitches.—Koppers Company and Affiliates, Pittsburgh, Pa.

KOPPERS

THE INDUSTRY THAT SERVES ALL INDUSTRY

Know the Name BOHN

Headquarters–

THIS organization is one of America's foremost designers and fabricators of aluminum, magnesium and brass products and aircraft-type bearings.

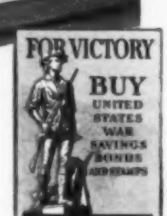
The advanced engineering achievements and vast resources of Bohn have made possible many non-ferrous alloy basic developments of great importance.

The whole chain of Bohn plants is now working night and day on war materials and will be, for the duration.

Because of the vital production and precision requirements for war materials, Bohn research and metallurgical studies have made possible many new applications for modern light alloys, which will be highly useful in industrial America of tomorrow.

Many leading manufacturers consider Bohn headquarters for aluminum, magnesium and brass products. Business consults Bohn because of the far-reaching experience this organization has had in its highly specialized field.

Remember the name Bohn. Some day, Bohn may be of assistance in helping plan your new products for a new era.



BOHN ALUMINUM AND BRASS CORPORATION, Detroit, Michigan

Designers and Fabricators

ALUMINUM • MAGNESIUM • BRASS
AIRCRAFT-TYPE BEARINGS


COFL

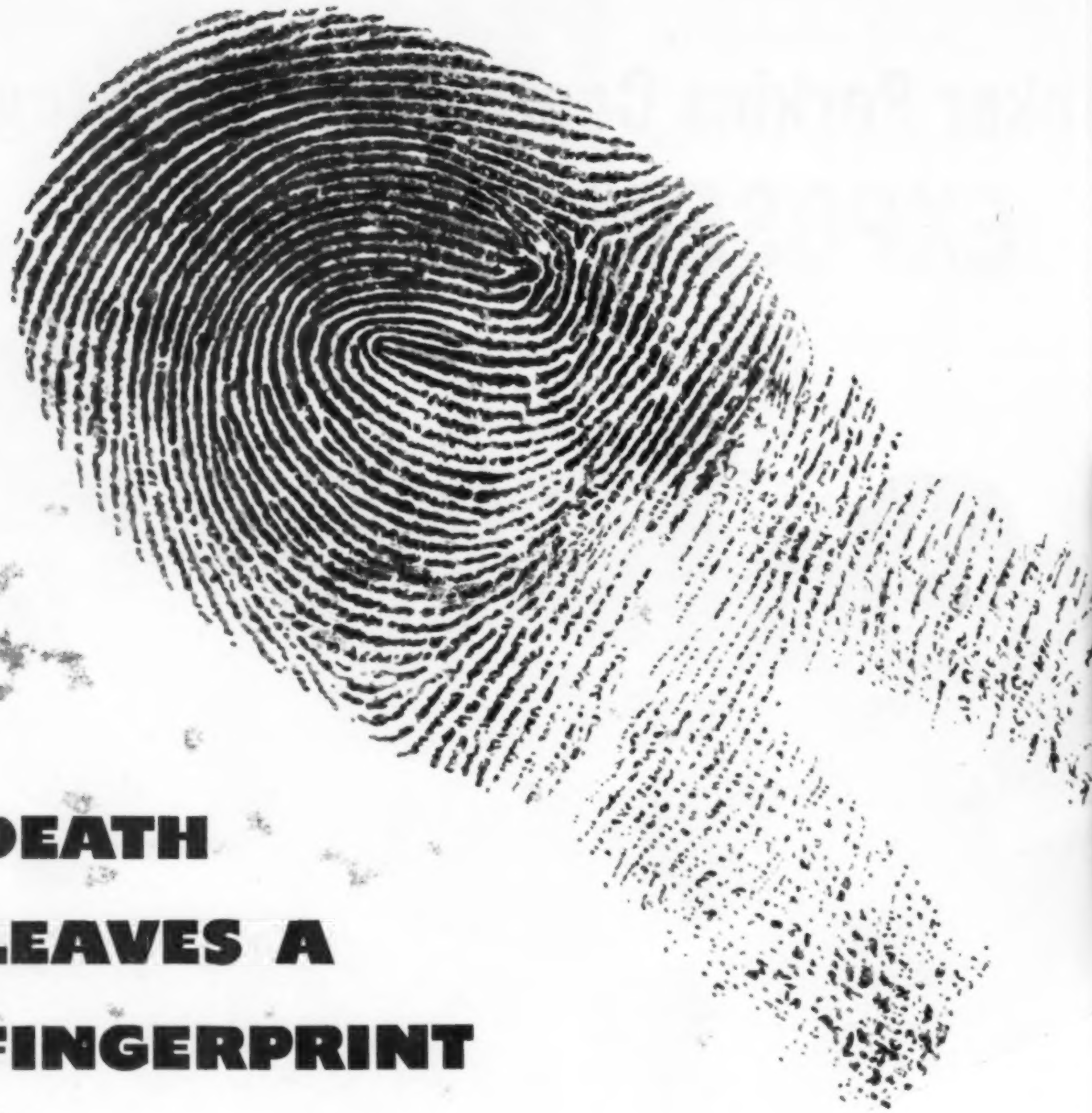
Baker Perkins Continuous Centrifugal

EXPOSED!

With the upper housings removed (as illustrated) you can see why the machine is so efficient. The entire mechanism is ingeniously simple. All moving parts—including the drum—rotate on the same axis at the same speed. The hydraulically-actuated inlet funnel and pusher (see inset) rotate with the drum and, at the same time, have a reciprocating motion, the frequency of which can be readily adjusted at all times. The centrifuged material moves across the drum with a constant thickness and speed. This permits uniformly-efficient washing by means of a fixed spray.

Because a B-P Centrifugal operates at constant speed, the power required is remarkably low. The smooth operation of its hydraulic control and the lack of any mechanical devices insure minimum maintenance costs. Because this unit contains no scrapers, rakes or plows, crystal degradation is held to a minimum. If your processing calls for the dewatering of any relatively free-draining crystalline, granular or fibrous slurries, it will pay you to investigate the possibilities of the Baker Perkins Continuous Centrifugal. BAKER PERKINS INC., SAGINAW, MICHIGAN.

BAKER PERKINS BUILDS EFFICIENT EQUIPMENT



DEATH LEAVES A FINGERPRINT

Probably it was hot and humid in the assembly room...that day when warm, perspiring fingers accidentally touched a tiny, needle-pointed shaft. But the fingerprint remained... acid, corrosive...

A saboteur—this accidental fingerprint? Yes—for on a later day that tiny part, weakened by corrosion, may fail—in a submarine depth-gauge, an airplane altimeter, or in any of scores of delicate military instruments. And just because of a fingerprint, a man may die.

* * *

ANOTHER WAR JOB FOR AIR CONDITIONING. Where precision instruments are made, on which men's lives depend, air conditioning reduces perspiration . . . filters out dust . . . helps speed output.

And this is but one example of how General Electric *air conditioning* and *industrial refrigeration* may serve the war effort. To meet the exacting requirements of these wartime applications, General Electric is producing equipment that is highly efficient . . . flexible . . . compact.

When peace comes, this improved air conditioning equipment — by General Electric—will be available to all.

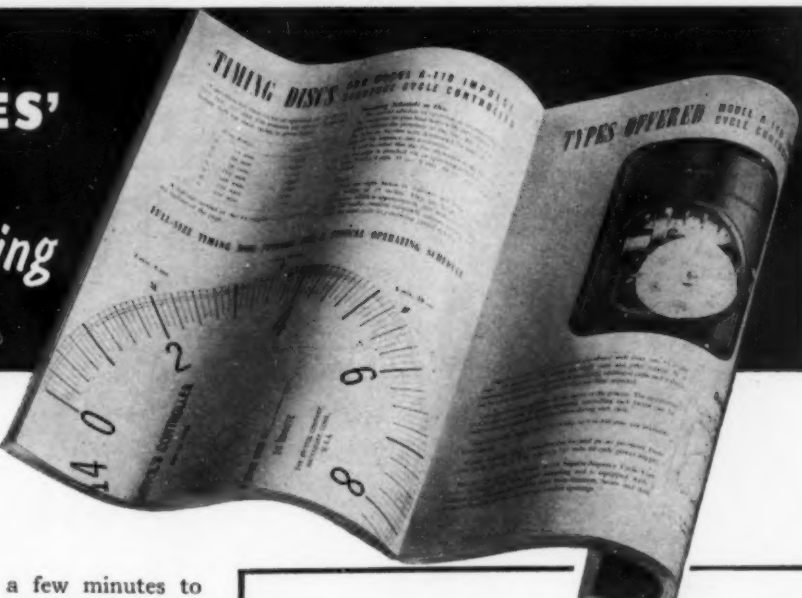
General Electric Co., Air Conditioning and Commercial Refrigeration Dept., Division 436, Bloomfield, N.J.

Air Conditioning by

GENERAL ELECTRIC

YOUR 5 MINUTES' READING

May Help His Fighting



When you take a few minutes to glance through a Bristol Bulletin . . . then write for further facts about Bristol's instrument-engineering in *your* industry . . . you may be taking the first step towards solution of one or more of the fundamental problems facing your plant today. Such problems as these, for instance, have often been solved by a wider, more efficient use of Bristol's automatic controls:—*1. Lack of skilled men . . . 2. Shortage of raw materials . . . 3. Need to increase output without increasing space or equipment. . . . 4. Unnecessary spoilage and rejects . . . 5. Errors in putting new products into production.*

Bulletin 572 — Typical of Bristol's Clear, Up-to-Date, Factual Information on Automatic Control of Mechanical Operations in Industrial Processes

Automatic timing of mechanical operations in industrial processes received its initial impetus when the Bristol Automatic Time-Cycle Controller was developed. Continuous improvements have been made through the years.

Here, in one concise 20-page bulletin, is a complete outline of this "template for efficient operation" — the mechanical operations you can control with it — the results in terms of quality, cost and increased production — details on its operation — and case studies illustrating its application to a wide variety of processes.

Bulletin 572 may point *your* way to a greater production efficiency than you have hitherto imagined possible. Write for it, together with any other bulletins described in the coupon.

THE BRISTOL COMPANY, Waterbury, Connecticut

The Bristol Co. of Canada, Ltd.
Toronto, Ontario

Bristol's Instrument Co. Ltd.
London, N.W. 10, England

BRISTOL

Engineers Process Control for Better Products and Profits

AUTOMATIC CONTROLLING AND RECORDING INSTRUMENTS

Maximum Production of Plastics Assured by Bristol Cycle Controller

Variations from one run to the other used to limit production of laminating presses making synthetic resin sheets. Today, a Bristol 4-Cam Cycle Controller, coordinated with time-temperature and time-pressure controllers (1) automatically closes the press, (2) increases temperature and pressure to required maximum, (3) times the soaking period, (4) cools the platens, (5) reduces pressure, and (6) automatically opens the press and resets the entire system for the next run — all at the push of a starter button!

FREE **Bulletins from Bristol's Library of Engineering Data — One of Them May Help You Increase Wartime Production**

THE BRISTOL COMPANY
109 Bristol Road, Waterbury, Connecticut

- ☐ Please send me Bulletin 572, described above. In addition send me any of the Bulletins checked below.
- ☐ Bulletin 512 — An introduction to Bristol's system of Coordinated Process Control, describing the type of problem solved by completely automatic systems, the type of operations controlled and several installations in modern processing plants.
- ☐ Bulletin 536 — Describes modern pH control instruments for a wide variety of processes requiring hydrogen ion measurement and automatic control; includes installation data, new glass electrode assembly and list of applications.
- ☐ Bulletin 103 — Automatic control of synthetic rubber processes with Bristol's instruments. Describes work done from pilot plants to complete installations, with diagrams showing controls applied to various processes.

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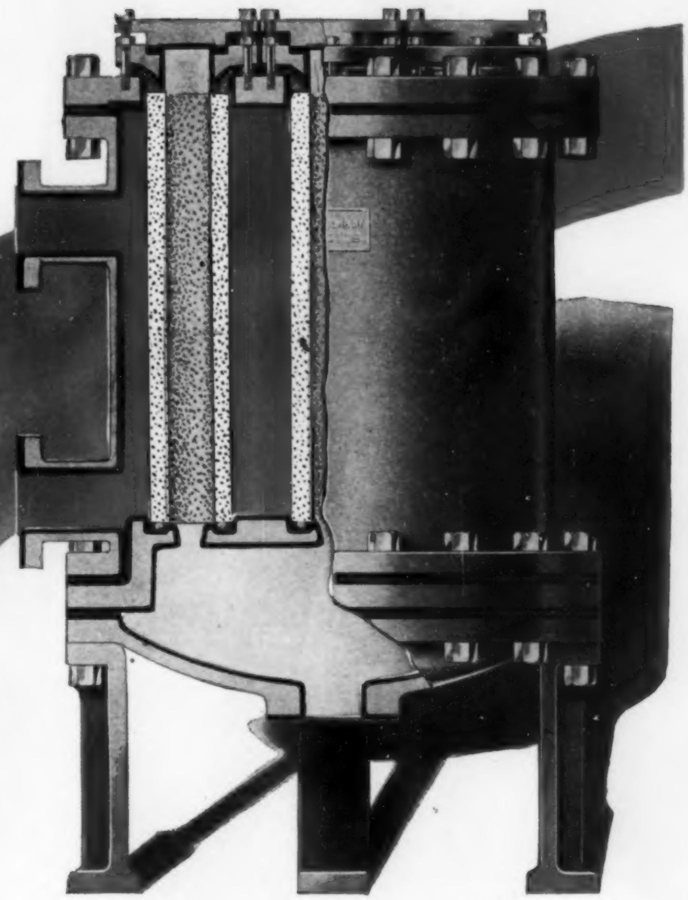
PORO-STONE *Filtration* *for* ACIDS



...AND CORROSIVE LIQUIDS

ADAMS PORO-STONE FILTERS embody the most advanced ideas in the design and construction of pressure filter equipment for acids and corrosive liquids. Supplied in two types—the rubber-lined "CFR" and the lead-lined "CFL"—each with its specific application depending on operating conditions. These totally enclosed filter units are compact, easily installed, readily cleaned by back washing. Special construction of PORO-STONE filter medium assures long life and a minimum of maintenance time and expense. Adaptable to a wide variety of industrial applications. Write for Bulletin 302, containing full details.

CORROSION RESISTANT

Heavy duty shell and all internal parts are lead or rubber lined. Corrosion resistant porous filtering medium and bonding material.

ACCESSIBILITY

Adams design permits inspection or removal of tubes without disturbing shell or piping conditions.

CLEANING

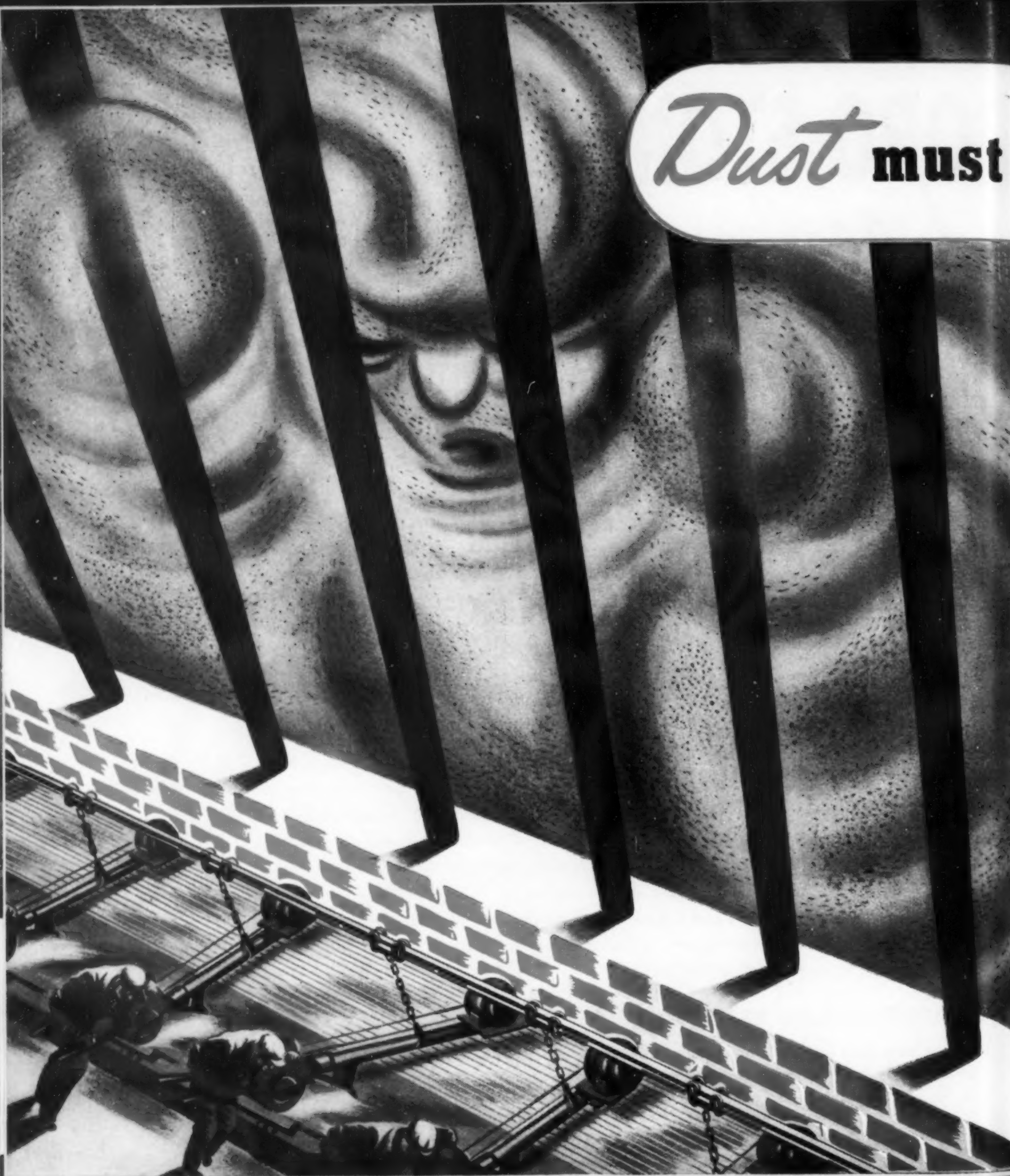
The cleaning process is easily, quickly and neatly accomplished by backwashing a single tube at a time or the complete shell.

INSTALLATION

The compact, self-contained design permits installation at floor level or elevated. Only three connections required.

R. P. Adams Co. 57 Chicago St. Buffalo, N. Y.

ADAMS *Poro-Stone* ACID FILTERS



Sturtevant Systems

REG. U. S. PAT. OFF.

AND EQUIPMENT

ENGINEERED FOR PRECISION-VENTILATING, HEATING, AIR CONDITIONING, DRYING, DUST AND FUME CONTROL, PNEUMATIC CONVEYING, MECHANICAL DRAFT

get life imprisonment in 194V

Under the lash of all-out production, Industry has learned many new reasons for keeping a close watch on Dust—and its treacherous ally, Fumes. Utilizing the most advanced development of Sturtevant Air Research and Engineering, industry has been able, through effective air control, to boost output, pare down operating costs, and improve product quality—to a degree never before thought possible.

Take the manufacture of aircraft engines, for example. Destructive dust from buffing and grinding operations must be whisked away as soon as it leaves the wheels. But there's an extra twist that Sturtevant Air Engineering gives this job. Instead of carrying off and wasting the conditioned room air, it's whirled through dust separators, purified and returned to the room with all its valuable heat intact. Savings at the coal pile run as high as $8,000 a year.

In giant booths where motorized equipment is spray painted, you'll find another Sturtevant dividend. Controlling the toxic fumes that spurt from spray guns was not enough. All air entering the room is now purged of dust or anything else that could impinge on freshly painted surfaces. Repainting was minimized and the production line went into high gear.

Processing metals at Victory-speed and efficiency calls for still another touch of Sturtevant genius. Acid fumes, destructive enough to eat through steel beams and keep labor turnover as high as 50% are now precision-controlled. Absenteeism is down to normal, costly equipment safeguarded and production quotas reach a new high.

And there are hundreds of new products, such as the miracle of making artificial wool from cow's milk, born with an inherent fume control problem that Sturtevant had to lick before production could be achieved.

Remember, all these advantages of dust and fume control—that are helping turn out better war goods, faster and more efficiently—will be equally important when industry returns to competing for postwar markets. Without "air at work," no plant can expect to compete on an equal footing.

ENGINEERED AIR will make a difference.

Yes, air that is engineered to serve efficiently—not only in dust and fume control but in all phases of industrial air conditioning, heating, ventilating, drying, pneumatic conveying, and mechanical draft—will make the difference between profit and loss in many a plant. And with new war-won knowledge, backed by experience as the pioneer in air-handling, Sturtevant will be in a position to find the most efficient and economical solution to your problems.

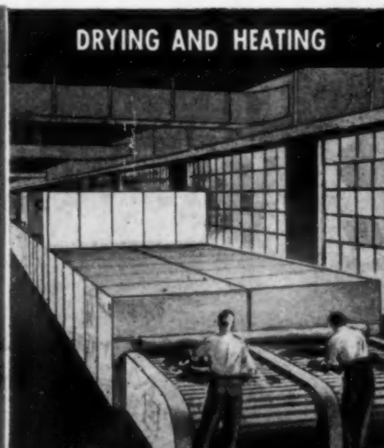
B. F. STURTEVANT COMPANY
Hyde Park, Boston, Mass. *Branches in 40 Cities*
B. F. Sturtevant Company of Canada, Ltd., Galt, Toronto, Montreal

STURTEVANT—FOUNDER OF THE AIR HANDLING INDUSTRY

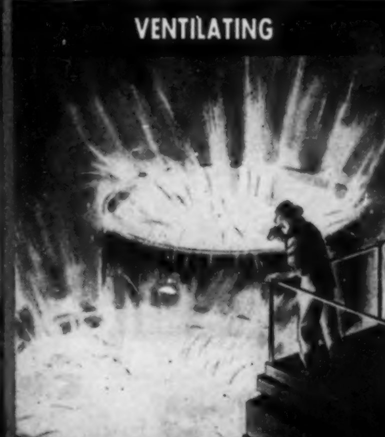
Sturtevant
REG. U.S. PAT. OFF.
Puts Air to Work

IR CONDITIONING

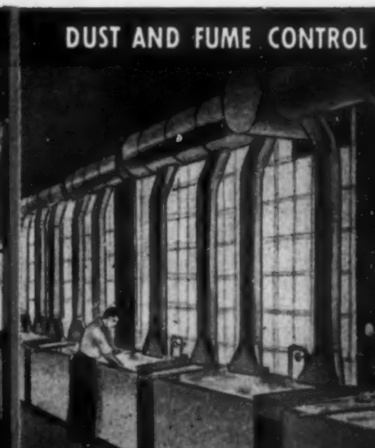
DRYING AND HEATING



VENTILATING

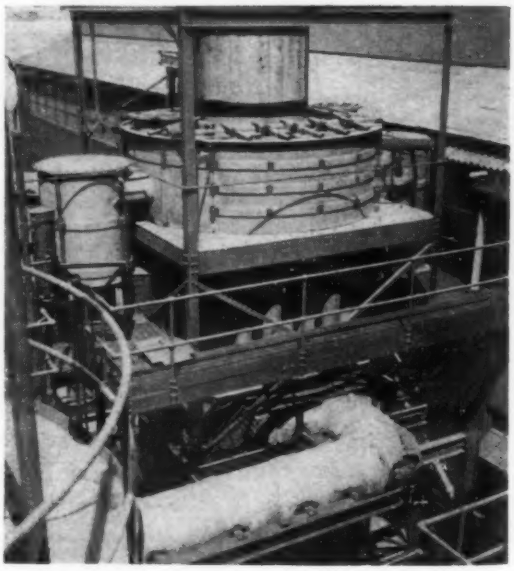


DUST AND FUME CONTROL



HOMOGENEOUS LEAD

The Unrestricted Rubber Substitute



When rubber wears out in process equipment, it must be replaced by LEAD wherever possible: Just how LEAD can be best used in YOUR equipment and how it will stand up in your service, can quickly be learned by calling KELLEY. A Kelley Homogeneous Lead Bonding will HOLD under any conditions of pressure, shock and vibration, wherever lead is suitable.

We also furnish lead castings, lead fittings of any size and shape, and install lead for TNT plants, nitrating equipment, acid and chemical plants.

We handle LEAD installations from initial engineering to final production. Consultation without obligation . . . write or wire.

• Typical Kelley Homogeneous Installations

E. I. duPont de Nemours & Co. (Inc.)
Hercules Powder Co.
Stone & Webster Engr. Corp.
Standard Oil Co.
E. B. Badger & Sons Co.
H. K. Ferguson Company
American Viscose Corporation
North American Rayon Corporation

O. G. Kelley & Company

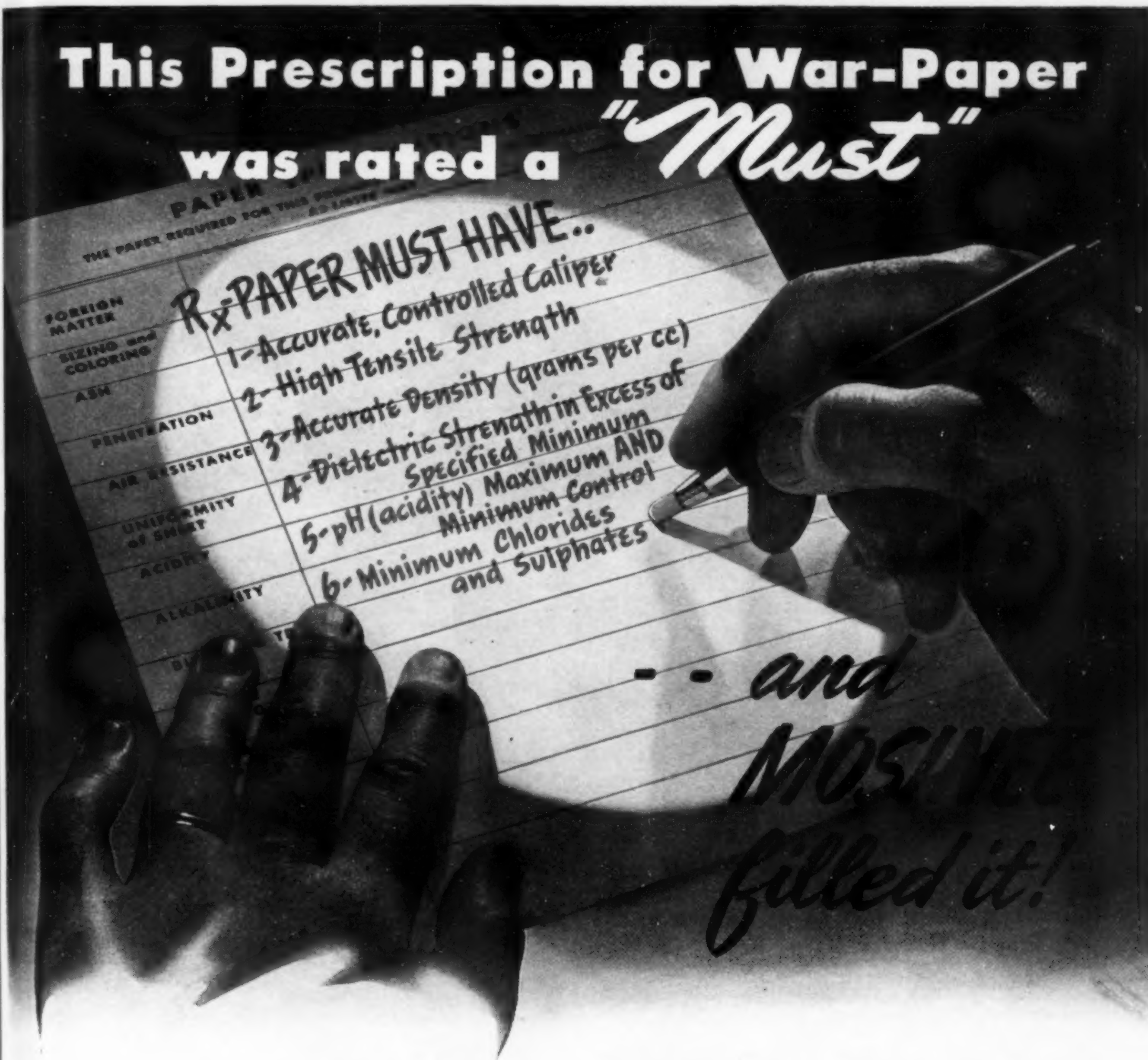
103 PARK AVENUE, NEW YORK

LEAD BURNING ANYWHERE IN AMERICA

JOHNSON CITY, TENNESSEE

(DORCHESTER STATION)

Boston, Mass.



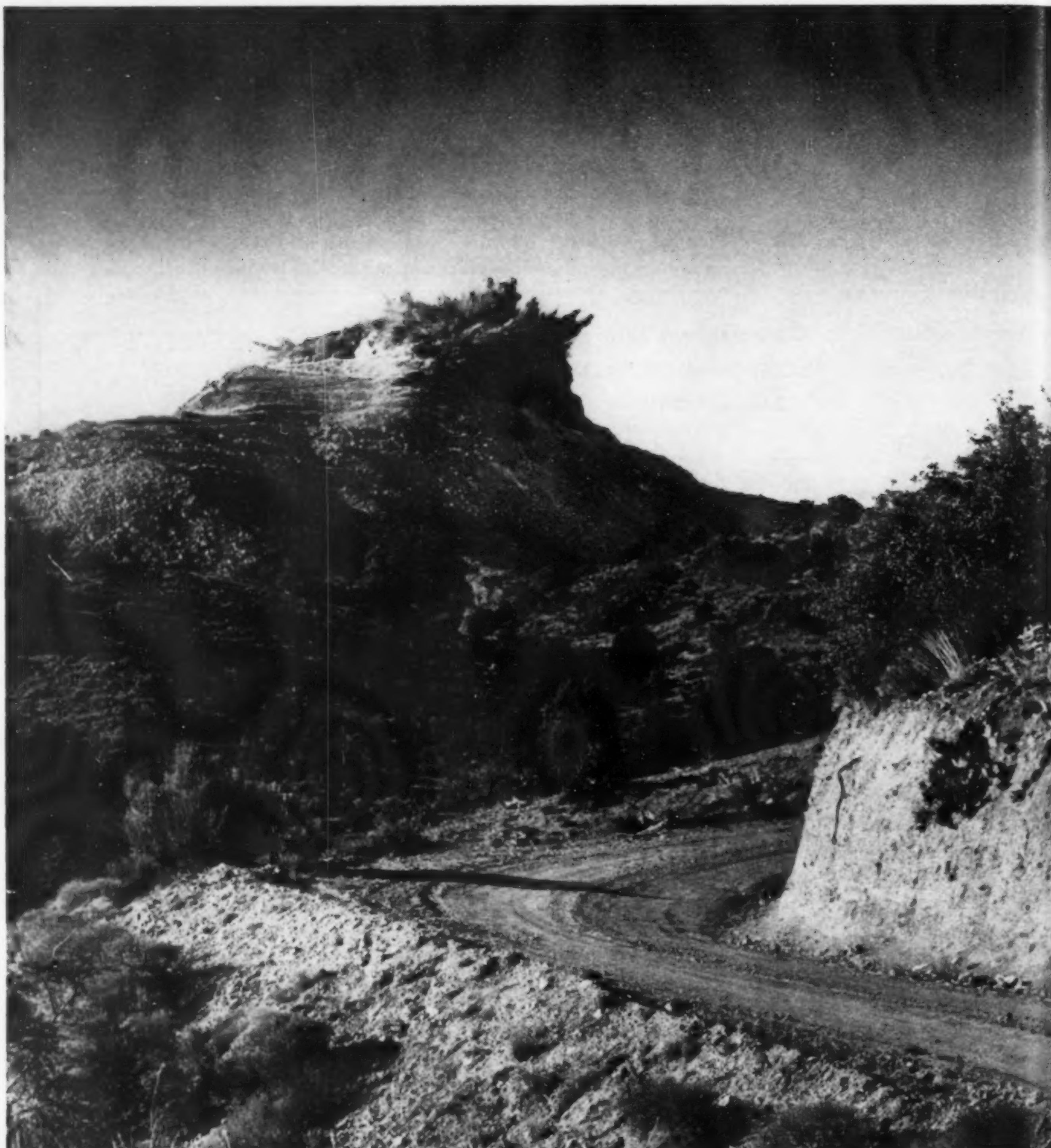
Manufacturer X had sold a product fabricated with paper made according to a prescription approximating the above. It had stood up for years under every test. Then came the war!

When used in certain new war weapons, the product failed. What was wrong? Study and analysis indicated that the cause of the failure was in the paper. The maximum limit of one of the ingredients, formerly ignored, now became the deciding factor of success or failure. Prompt adjustment in processing the paper, rewriting the prescription and establishment of control for the new limitation, prevented further failures . . . Perhaps you have a "paper prescription" that needs rewriting. Our engineers will contact you, at your request, to consult with your technicians. No obligation.

Please address your letter "Attention Dept. C"

MOSINEE PAPER MILLS COMPANY
MOSINEE • WISCONSIN

Essential Paper Makers



Hastelloy Alloys

are Strong and Tough!—and Highly Resistant to Corrosive Media . . . .

Hastelloy alloys—types A, B, C, and D—combine outstanding corrosion resistance with excellent physical properties. Each was especially developed to withstand the action of one or more of the common mineral acids or other strongly corrosive agents over a wide range of temperatures and concentrations. Alloys A, B, and C compare in tensile properties to high-strength steels, while alloy D possesses high hardness and wear resistance.

Shown below is a condensed table of mechanical properties of the Hastelloy alloys. For more complete information on mechanical and physical properties, penetration test results, available forms and methods of fabrication, send for the 40-page booklet, "Hastelloy High-Strength Alloys."

MECHANICAL PROPERTIES OF HASTELLOY ALLOYS

	Hastelloy Alloy A		Hastelloy Alloy B		Hastelloy Alloy C		Hastelloy Alloy D
	Cast Metal	Rolled Metal Annealed	Cast Metal	Rolled Metal Annealed	Cast Metal	Rolled Metal Annealed	Cast Metal
Ultimate Tensile Strength, lb. per sq. in.	69,000-77,500	110,000-120,000	75,000-82,000	130,000-140,000	72,000-80,000	115,000-128,000	36,000-40,500
Yield Point, lb. per sq. in.	42,500-45,000	47,000-52,000	55,000-57,000	60,000-65,000	45,000-48,000	55,000-65,000	
Elongation in 2 in., per cent	8-12	40-48	6-9	40-45	10-15	25-50	0
Reduction of Area, per cent	16-18	40-54	10-13	40-45	11-16		0
Hardness, Rockwell / Brinell	B 85-94 / 155-200	B 94-97 / 200-215	B 92-99 / 190-230	B 96-100 / 210-235	B 89-97 / 175-215	B 84-95 / 160-210	C 50-55
Izod Impact Strength, ft.-lb.	25-35	62-77	11-16	68-78	9-14	34-40	
Erichsen Value, Depth in mm.		10-11		10-11		8-9	
Transverse Breaking Load, 12-in. span, lb. deflection, in.							5,000 / 0.070-0.080
Modulus of Rupture, lb. per sq. in.							78,000
Modulus of Elasticity, lb. per sq. in.	27,000,000		30,750,000		28,500,000		28,850,000

Note: The values given are averages and average ranges obtained with a limited number of specimens. They will serve as a reasonable guide for the engineer or designer planning equipment of Hastelloy alloys.

HASTELLOY TRADE MARK

HAYNES STELLITE COMPANY

Unit of Union Carbide and Carbon Corporation

New York, N. Y. UCC Kokomo, Ind.

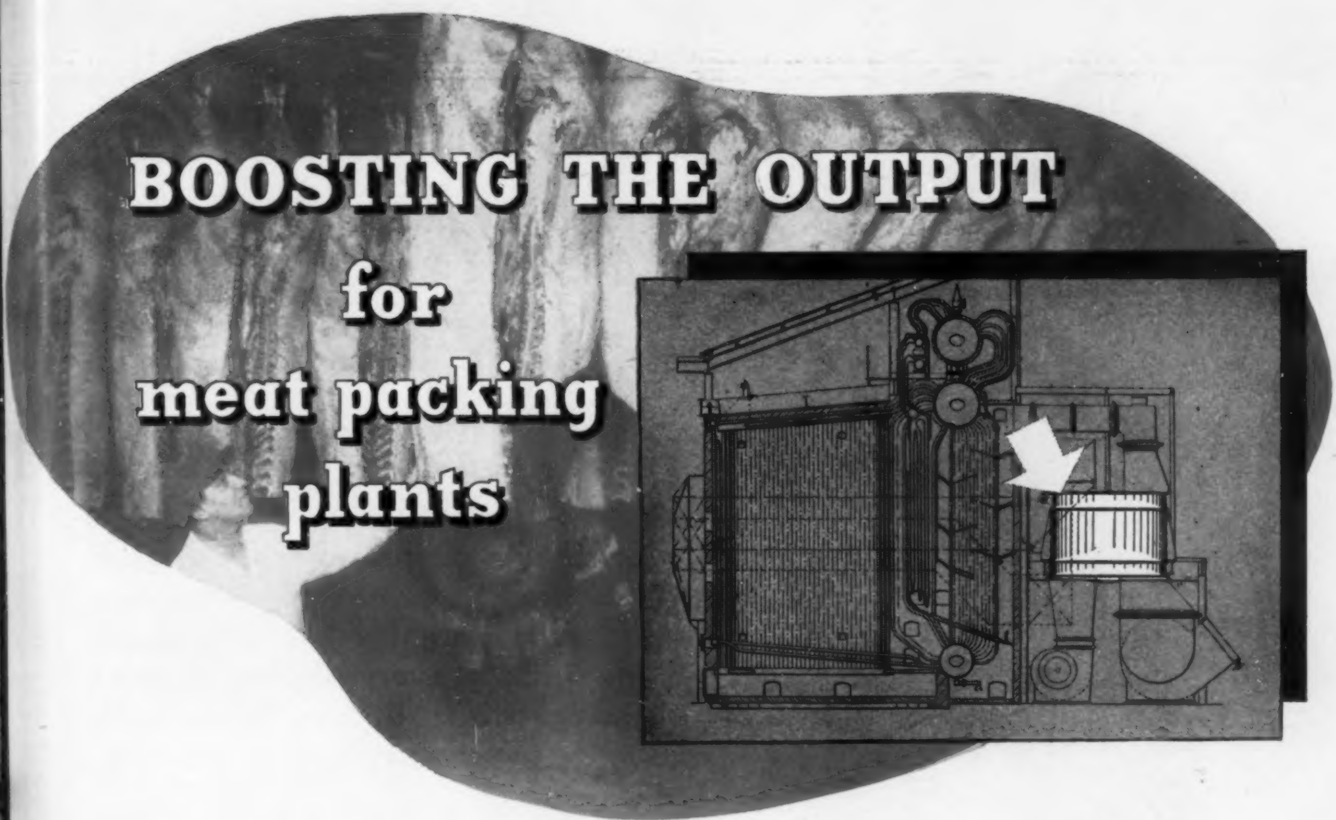
Chicago—Cleveland—Detroit—Houston—Los Angeles—San Francisco—Tulsa

HIGH-STRENGTH NICKEL-BASE ALLOYS FOR CORROSION RESISTANCE

The word "Hastelloy" is a registered trade-mark of Haynes Stellite Company.


For their sake
THE LOUIS ALLIS CO., MILWAUKEE, WIS.


LOUIS
ALLIS
The
Most Powe
in the
Least Spac
!



Ljungstrom Air Preheaters help mid-western central station fill packers' power and steam demands

During 1942, two of these Ljungstrom-equipped steam generating units were on the line 97% of the time . . . and their availability was over 98%. Fired by natural gas, each unit has a continuous capacity of 200,000 lb. steam per hr. Flue gases enter the preheater at 700° F., leave at 350° F., heating incoming air to 560° F., as an aid to efficient combustion. Heat recovery in the preheater is a significant factor in holding efficiency at 82.9%, which meets the design estimate for natural gas firing.

. . . . .

Food packing plants...synthetic rubber plants... munitions manufacture . . . wherever the war is forcing steam generation to the limit, Ljungstrom Air Preheaters are establishing highly favorable records of practical, full-time performance.

These *service* advantages are over and above the initial *engineering* advantages of the Ljungstrom: its saving of steel, its conservation of space, and the extra efficiency of its *continuance regenerative counterflow* principle.

These highly flexible gas-to-air heat transfer units are now finding application in many processing operations outside the field of steam generation, as on oil heating furnaces. For facts and figures, write:

THE
AIR PREHEATER
CORPORATION

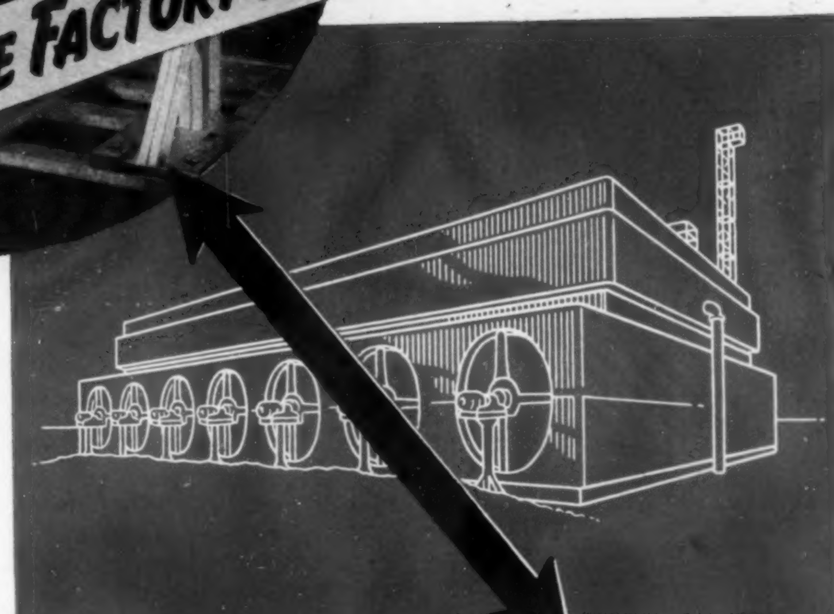
Executive Offices: 60 East 42nd Street, New York, N. Y. • Plant: Wellsville, New York

SIMPLIFY LAYOUT PROBLEMS

CUT INSTALLATION TIME

SAVE CRITICAL MATERIAL

WITH LOW-VOLTAGE FACTORY-ASSEMBLED CONTROL



FOR CORROSIVE OR HAZARDOUS GAS LOCATIONS

● Now you can order a complete low-voltage control system as easily as you can order a magnetic switch—saving precious engineering and drafting time on problems of layout. Here's everything you need between feeder and motors in a single control unit.

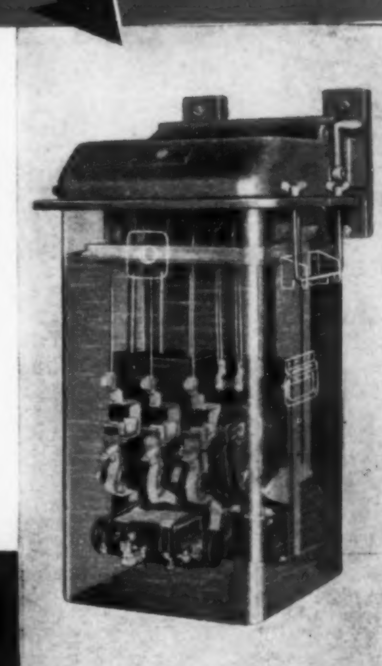
● Piecemeal installations, which consume valuable time in selecting, ordering, and laying out separate controls, are eliminated with group control. These starters are factory-assembled into a group, which is wired and shipped as one complete unit. You have only to set this compact, space-saving unit in place and connect the incoming line and outgoing motor leads.

● Because they are pre-assembled into groups, these "racked-up" low-voltage controls save the critical materials required for conduit, junction boxes, and special fittings on separately-mounted devices.

● For complete details of the advantages of group controls, and specific suggestions as to where you can apply them, get in touch with our local office, or write General Electric, Schenectady, N. Y.

For cooling-tower fan motors, low-voltage group control is ideal. Other uses are: controlling motors driving blowers, transfer pumps, circulating pumps, and many other equipments used in catalytic cracking, blending and treating, fractionating, and numerous other chemical and refinery processes.

Installed indoors or outdoors, the CR7008, oil-immersed combination motor starter contains, in a single unit, the equipment required for controlling and protecting a motor: (1) A manually-operated circuit breaker for short-circuit protection and disconnecting. (2) A long-lived, dependable magnetic starter for push-button control of the motor.



GENERAL ELECTRIC

676-88-8920

Masterpieces OF POTTERY

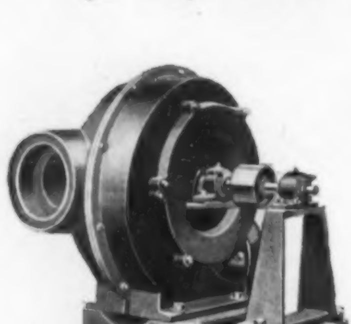


FIG. 100
EXHAUSTER
ON BASE

TODAY, in contrast to Della Robbia's "experiments" with firing and glazing, we, at General Ceramics, *know* the peculiarities of fired clay—we *know* that to obtain the very best in vitrified stoneware, clay must undergo a period in air drying with controlled conditions of temperature and humidity—we *know* the proper length of firing time and at what degree the temperature must be kept.

General Ceramics Chemical Stoneware is made from finest obtainable clays, is carefully molded—mechanically and by hand—and is fired at a high temperature. The result is a durable, acid-proof body which insures plant personnel and property against hazardous leaking. The hard glazed surface of General Ceramics Chemical Stoneware is easy to keep clean, thus eliminating product contamination.

Among the many products manufactured by General Ceramics are acid-proof pipe, valves, fittings, kettles, jars, pots, pumps, exhausters, coolers, condensers, acid elevators, towers, filtering equipment and tourills.

Other products include Steatite Insulators made by General Ceramics & Steatite Corp., Keasbey, N. J.

General Ceramics Co.

GENERAL CERAMICS COMPANY
CHEMICAL STONEWARE

CHEMICAL STONEWARE DIV.

KEASBEY • NEW JERSEY

HERE'S YOUR ANSWER TO VALVE PROBLEMS

in the control fluids with high viscosity or corrosive properties and those containing suspended solids. These valves will not contaminate food products, drugs or chemicals.

GRINNELL-SAUNDERS DIAPHRAGM VALVES

Screwed and Flanged Patterns

Features of Particular Interest to Chemical and Process Industries:

1 No packing glands to demand constant attention.

2 Non-rising stem eliminates breakage. Stem is protected from dust, weather and corrosion.

3 Working parts completely isolated from the fluid. No sticking, corroding or clogging to interfere with easy operation and tight closure. No contamination from valve lubricants.

4 Compressor and finger plate combine to support the diaphragm in all positions.

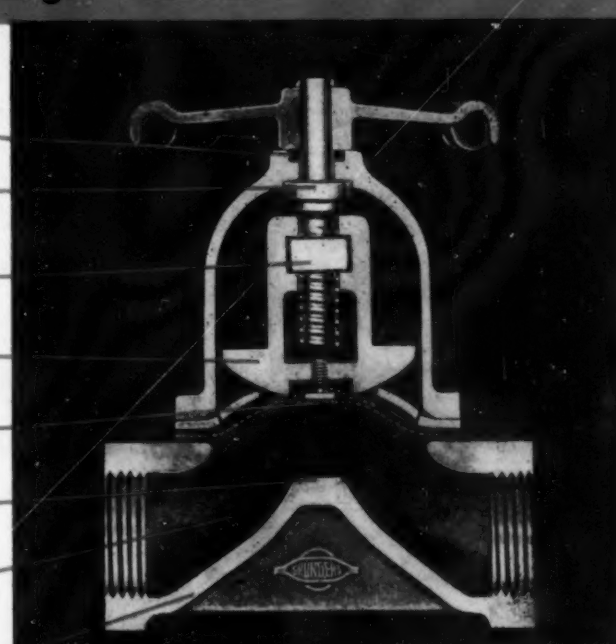
5 The large area of contact of the diaphragm on the seat, plus the resilience of the diaphragm, permits positive closure even when foreign matter is trapped.

6 No metal-to-metal seats to become damaged, wire drawn or scored. No refacing, reseating or grinding is required.

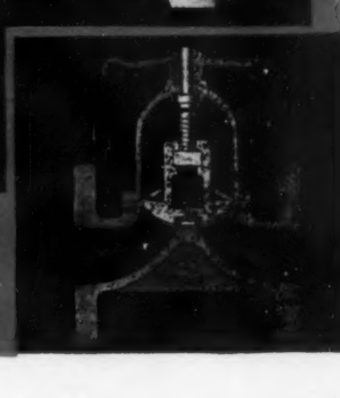
7 Streamlined passage without pockets reduces friction to a minimum and prevents accumulation of sludge and foreign solids.

8 The valve body – the only metal that could contact the fluid – can be completely lined with glass, porcelain, lead, rubber or synthetic compounds to suit service requirements.

Write for copy of Catalog 1-S which describes these valves. Grinnell Company, Inc., Executive Offices, Providence, R. I. Branch offices in principal cities.



VALVE OPEN



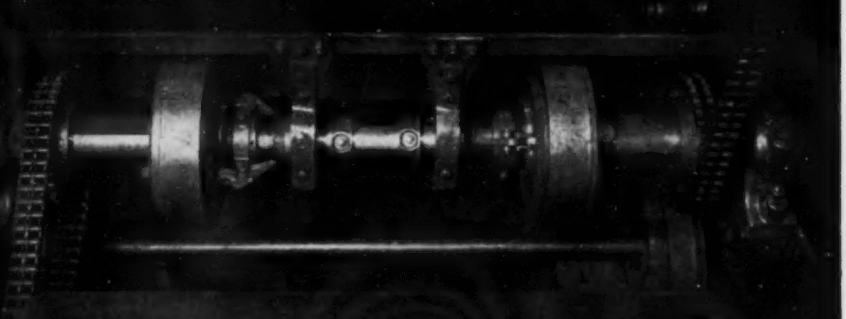
VALVE CLOSED

GRINNELL

WHENEVER **PIPING** IS INVOLVED

FULL POWER *Control*
FREE POWER *Flow*
WITH STURDY DODGE FRICTION CLUTCHES

Dodge Solid Friction Clutches in duplex on reversing mechanism of self-propelled hand-reversed Tripper for Belt Conveyor.



ADEQUATE control of power-flow over the power "roadbeds" of your plant, will minimize power loss. Rugged Dodge Friction Clutches, stationed at proper places on your line shafts or on your machines, assure positive control, and release capacity loads, without loss . . . delivering more horsepower to production machines, to boost battle power!

The Dodge Solid Friction Clutch is one of several popular Dodge types, outstanding for sturdiness, simplicity and economy. It can be quickly furnished for use as a cut-off coupling or with sleeves for mounting pulleys, sheaves, gears or sprockets.

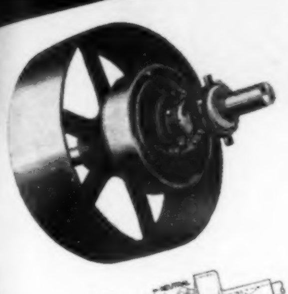
For power transmission on line shaft or on clutch-operated mobile machinery, you'll find the right clutch for every job in the complete Dodge line. Teamed up with other Dodge Power Transmission Equipment, they put all the power into the job, to maintain peak production.

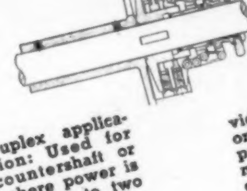
Nearest Dodge Distributor can help you determine whether Dodge Solid, Split, Expanding Ring or Diamond "D" Clutches answer your purpose . . . or write to

DODGE MANUFACTURING CORPORATION
MISHAWAKA, INDIANA, U. S. A.

DODGE SOLID FRICTION CLUTCH

Clutch with sleeve, used with pulley, sheave, gear or sprocket. Can also be furnished without sleeve for use as cut-off coupling.





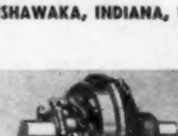
Multiple disc construction reduces pressure required for power transmission. Makes clutch easy to operate. Simple, one-point adjustment provides take-up for any wear on friction surfaces. Compound toggle (on larger sizes) multiplies pressure on shifter; also insures positive release of clutch.

Duplex application: Used for countershaft or machine operations where power is to be delivered alternately to two different points (as in main illustration above). Single shifter engages one clutch or the other.

Dodge Diamond "D" Friction Clutches
High precision, extremely rugged, compact, simple, fully enclosed, protected against dirt or dust whether engaged or disengaged. Generous safety factor above rated capacity, for momentary shock loads.

Dodge Expanding Ring Friction Clutches
A machinery clutch . . . compact, rugged, extremely simple, fully enclosed for protection against dust or dirt. Convenient one point self-locking adjustment. Suitable for a wide variety of light machinery applications.

Dodge Solid Friction Clutches
Friction disc type, adapted for general power transmission service as well as many types of machinery applications. Rugged, simple in design, easy to adjust and maintain. Widely used on machinery subjected to severe service.



Dodge Split Friction Clutches
For severe, continuous power transmission service on big installations. Particularly suitable for large shafts operating at slow to medium speeds. Split construction permits easy installation on shafting already in place. Parts interchangeable for replacements.

DODGE
MISHAWAKA

THROW ALL YOUR SCRAP INTO THE FIGHT! BUY MORE WAR BONDS!

THE RIGHT DRIVE FOR EVERY JOB

Dodge Diamond "D" Clutch equipped with Dodge Style "ED" Shifter.

PUT *ALL* YOUR POWER IN THE JOB

Power FOR THE MACHINES OF VICTORY—THROUGH DODGE-TIMKEN TRANSMISSION EQUIPMENT

A modern group drive installation using Dodge transmission units equipped with Timken Bearings.

The group drive as demonstrated by this Dodge-Timken installation, represents an efficient and economical method of utilizing power for machine operation.

By enabling machines to be operated in small groups Dodge-Timken Group Drives permit much shorter line shafts to be used and help to reduce loss of production time due to involuntary shutdowns by (a) greatly curtailing the possibility of line shaft trouble and (b) limiting work stoppage to a few machines in the event such trouble should occur.

Naturally Timken Tapered Roller Bearings contribute materially to these benefits by eliminating friction, simplifying lubrication and minimizing maintenance. Their ability to carry radial, thrust and combined loads and to hold moving parts in correct and constant alignment add greatly to the endurance of any kind of equipment in which they are installed. The Timken Roller Bearing Company, Canton, Ohio.

Stress production for Victory — but don't lose sight of what may follow. Raise the performance standards of your machines now by the use of Timken Bearings wherever suitable; re-design if you have to.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

When *Black* Means *White!*

OUT OF CARBON . . . blackest substance man knows . . . comes the whitest, brightest light that man has achieved . . . that of the carbon arc lamp. With an intensity of light rivaling that of the sun, the useful carbon arc is necessary in giant searchlights for anti-aircraft defense, battleships, and other vital uses . . . in motion picture projectors . . . in sun lamps that heal and lamps that increase the vitamin D content of milk . . . in accelerated testing equipment that points the way to longer life for fabrics, paints, plastics, and other materials you use.

Without carbon and its wonders, our electrical civilization could not have been born. For without brushes made from carbon, electricity for light and power could not be generated in vast amounts . . . today's automobiles would not run . . . today's airplanes would not leave the ground.

Without carbon, in the form of electrodes and anodes, much of the highest quality steel, many of the chemicals, and other useful substances vital to this nation could not be made. For years, NATIONAL CARBON COMPANY, INC., a Unit of UCC, has studied carbon and graphite . . . their properties and uses . . . and has made useful things from them. Much has been accomplished. Through further research in carbon, more answers for tomorrow's problems are being found.

Research and engineering developments in carbon made by National Carbon Company, Inc., have been tremendously facilitated by the electric-furnace experience and the knowledge of industrial gases and chemicaus of other Units of Union Carbide and Carbon Corporation.

BUY UNITED STATES WAR BONDS AND STAMPS

ACTION! CAMERA! Without the high-intensity carbon arc . . . used for photographing motion pictures and projecting them in theaters . . . we would not have the high-quality motion pictures of today.

CARBON, THE VERSATILE. In addition to its electrical uses, electric furnace graphite, a form of carbon, is used for making absorption towers, heat exchangers, and pumps for corrosive liquids; and for making metallurgical molds.

MAN-MADE INFERNO. Modern alloy steels are made in electric furnaces. These furnaces depend upon huge carbon and graphite electrodes for intense heat. They help make more . . . and better . . . steels.

LIFE SAVER. Activated carbon is necessary for gas masks to give protection against industrial and war gases. It also aids in the recovery of millions of pounds of solvents used by industry each year.

UNION CARBIDE AND CARBON CORPORATION

30 East 42nd Street UCC New York, N. Y.

Principal Products and Units in the United States

ALLOYS AND METALS
Electro Metallurgical Company
Haynes Stellite Company
United States Vanadium Corporation

CHEMICALS
Carbide and Carbon Chemicals Corporation

ELECTRODES, CARBONS AND BATTERIES
National Carbon Company, Inc.

INDUSTRIAL GASES AND CARBIDE
The Linde Air Products Company
The Oxweld Railroad Service Company
The Prest-O-Lite Company, Inc.

PLASTICS
Bakelite Corporation
Plastics Division of Carbide and Carbon Chemicals Corporation

OF DISSIMILAR METALS

And how milliampere Gremlins may be foiled at their own game

Today, dissimilar metals must frequently be used in more or less untried combinations. This is made necessary by metal shortages and urgent production needs.

Such combinations when exposed to liquids or moisture can result in serious galvanic corrosion. Therefore galvanic couples now merit much closer attention by plant and design engineers than was previously necessary.

Also, since its effects are not readily distinguished from those of the ordinary types of corrosion, it frequently is blamed for troubles it could never cause. Yet when really present, galvanic corrosion may be very serious.

Practices for controlling Galvanic Corrosion

1 Select combinations of metals as close together as possible in the Galvanic Series.

2 Avoid combinations where the area of the less noble material is relatively small. It is good practice to use the more noble metals for fastenings or other parts in equipment built largely of less corrosion resistant material.

3 Insulate dissimilar metals wherever practical. If complete insulation cannot be achieved, anything such as paint or plastic coatings at joints to increase the resistances of the circuit will help.

4 Keep dissimilar metals as far apart as possible. This rule applies even when the actual connection between the metals is made external to the corrosive liquid.

5 Apply coatings with caution. For example, when painting—do not paint the less noble material without also coating the more noble, otherwise greatly accelerated attack may be concentrated at imperfections in coatings on the less noble metal. *Keep such coatings in good repair.*

6 Prevent or limit aeration of the corrosive liquid as much as possible to sustain the polarizing effect of the hydrogen film which forms on bare cathodic surfaces.

7 If practical, add chemical inhibitors to the corrosion solution according to the nature of the solution to be inhibited.

8 Avoid joining materials well apart in the series by threaded connections, as the threads will probably deteriorate excessively. Brazed joints are preferred when practicable.

9 Whenever possible, install relatively small replaceable sections of the less noble material at joints and increase the thickness of the less noble material in such regions; for example, by using extra heavy wall nipples in piping or by attaching replaceable pads to critical surfaces.

10 Install pieces of bare zinc or steel to provide a counteracting galvanic protection effect to suppress galvanic corrosion.

•

INCO's Technical Service is prepared to assist metal users in solving galvanic corrosion problems. Available data from INCO's Corrosion Files for a particular combination of metals will be furnished wherever possible. Aid can also be extended in applying general principles to specific problems.

As a first step in securing INCO's help on a specific corrosion problem, write for a copy of the Corrosion Data Work Sheet.

THE INTERNATIONAL NICKEL COMPANY, INC., 67 Wall Street, New York, N. Y.

GALVANIC CORROSION *and* THE GALVANIC SERIES

Galvanic Corrosion is caused by contact or connection of unlike metals in a corrosive liquid. Because generation of electric current is associated with galvanic corrosion, the metals act like a galvanic cell and corrosion action may become more serious and more rapid than that fostered by the corrosive liquid acting on the metals separately. Such action may be prevented or minimized by using the Galvanic Series to guide the selection of metal combinations.

GALVANIC SERIES

Corroded End (anodic, or least noble)

Magnesium
Magnesium alloys

Zinc

Aluminum 2S

Cadmium

Aluminum 17ST

Steel or Iron
Cast Iron

Chromium-iron (active)

Ni-Resist

18-8 Stainless (active)
18-8-3 Stainless (active)

Lead-tin solders
Lead
Tin

Nickel (active)
Inconel (active)

Brasses
Copper
Bronzes
Copper-nickel alloys
Monel

Silver solder

Nickel (passive)
Inconel (passive)

Chromium-iron (passive)
18-8 Stainless (passive)
18-8-3 Stainless (passive)

Silver

Graphite
Gold
Platinum

Protected End (cathodic, or most noble)

According to studies and practical experience from which the Series resulted, metals within a group have no strong tendency to produce galvanic corrosion of each other and therefore make relatively safe combinations unless the area of the less noble is markedly smaller.

The coupling of two metals from different groups and distant from each other in the list can result in galvanic, or accelerated corrosion of the less noble material. The farther apart the metals stand, the greater will be the galvanic tendency.

Although the arrangement of metals in the Series is based on results of experiments and practical experience involving many common corrosives, it cannot replace the need for tests when unusual corrosives are encountered or when other unusual conditions prevail that may cause major shifts of the relative positions of metals in the Series.

THE 'AIR ARM' OF INDUSTRY

Applying Compressed Air for countless jobs is one of Ingersoll-Rand's major contributions for the industries of war and peace.

Armies of drill runners mining the vital metals, building the strategic roads and air fields, driving the tunnels for highways, railroads and water—all with rock drills powered by Compressed Air.

Thousands of men, women too, building planes, ships, tanks, autos, trucks, locomotives, bridges, machines, and process plants—with drills, grinders, riveting hammers, chippers, hoists—powered by Compressed Air.

Today's war production also emphasizes the use of Compressed Air for propelling torpedoes, scavenging guns, starting Diesels, for painting, for ship salvage, for blasting sirens, for inflation of tires, for blowing blast furnaces and cupolas to increase steel production....

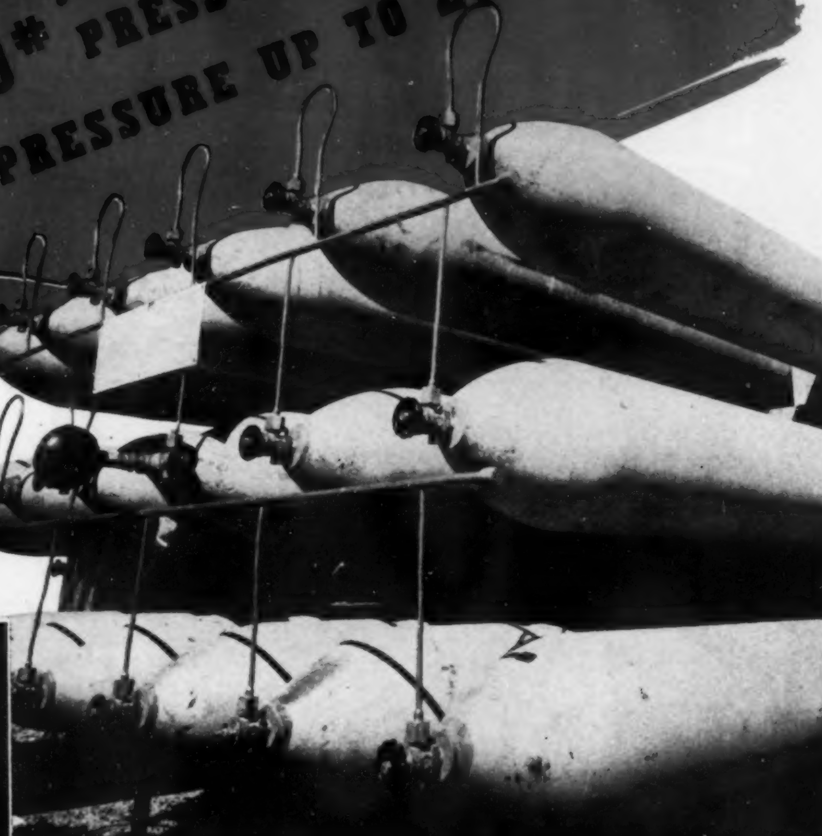
Ingersoll-Rand has pioneered Compressed Air Systems since 1871, ever developing new and time-saving applications.

Ingersoll-Rand

11 Broadway, New York, N. Y.

1-280

OMPRESSORS • TURBO BLOWERS • ROCK DRILLS • AIR TOOLS • OIL AND GAS ENGINES • CONDENSERS • CENTRIFUGAL PUMPS




INCREASE
DECREASE
REGULATED PRESSURE
OPEN
CLOSE
CLOSE
OPEN
OXYGEN REGULATOR
GROVE REG. CO.


LIGHTER-WEIGHT CONTAINERS
FOR HIGH-PRESSURE GASES
WEIGHT saved on aviation equipment means more fire power, bigger cargo loads. So Kidde engineers have trimmed precious ounces from containers used for storing oxygen, carbon dioxide and other gases and liquids. These cylinders, though lighter, are built to withstand safely the high internal pressures to which they are subjected.
Walter Kidde & Company is "headquarters" for high pressure containers. Here you'll find cylinders in a variety of sizes and shapes, and release mechanisms of many types.
If you are storing high-pressure gases or liquids, let Kidde engineers help you get the right containers. Write to us today about your requirements.
Walter Kidde & Company
Incorporated
623 Main St., Belleville, N. J.
PROTECTS LIVES
Kidde
HIGH PRESSURE GASES • FIRE PROTECTION

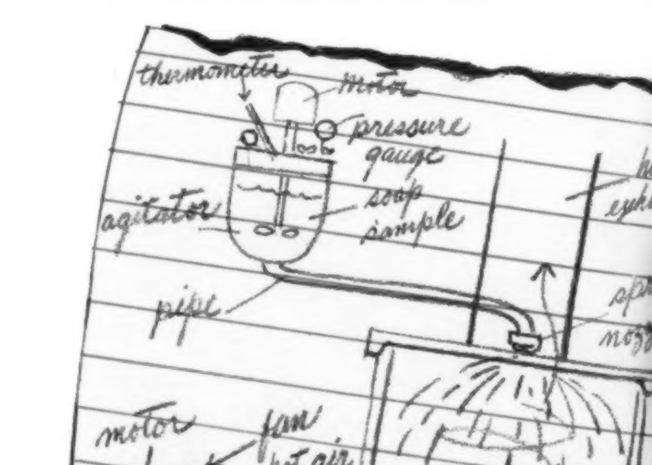

CHEMICAL COTTON
TERPENE CHEMICALS
SYNTHETICS

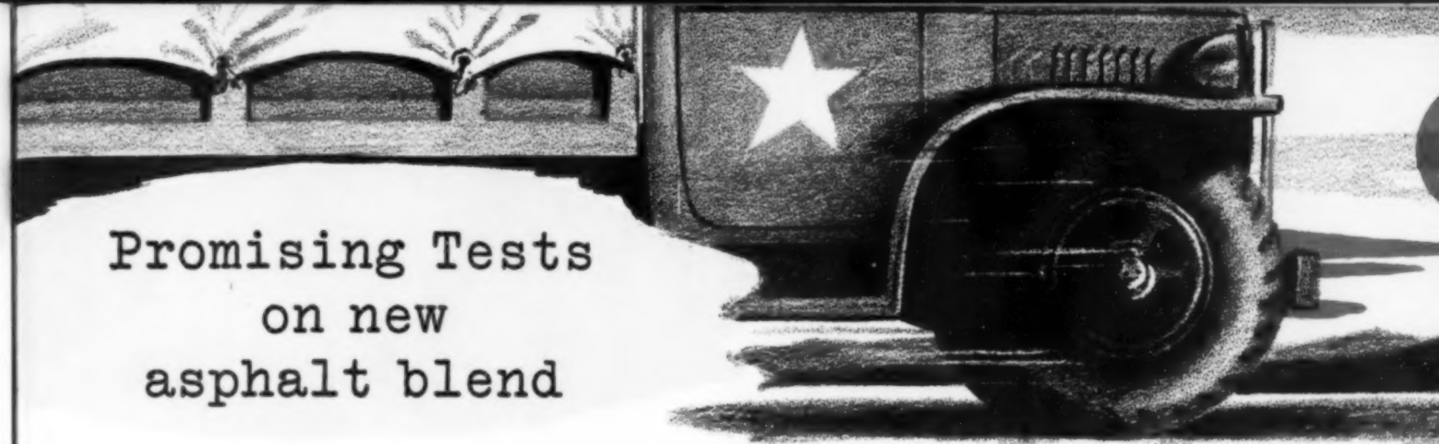
Lacquer for Leather

All types of leather can now be waterproofed and made to stay beautifully soft and pliable with a nitrocellulose lacquer emulsion developed by Hercules. This emulsion enables the lacquer to remain on the surface, giving the leather better flexibility, wearability, improved appearance, and greater resistance to scuffing. At the present time it is being used for aviators' jackets, helmets, and other wearing apparel as well as many types of upholstery leather. It is available in every color of the rainbow, and may be applied to the leather by practically any process. For further information, write Cellulose Products Department, Hercules Powder Company.

Commercial spray-dried soaps duplicated in the laboratory

In a three-year study of the uses of rosin in soap, it was necessary to duplicate in small lots the spray-dried soaps commercially produced in runs of many tons. Obtaining these soap samples in the laboratory was a difficult problem solved by building a unique spray-dry machine based on the rough sketch shown here. This machine makes one- to two-pound batches which are comparable in every respect to the powdered soap made in commercial-size equipment. The findings of Hercules' three-year soap study are reported in a 24-page book, "Rosin . . . its place in Soap." We shall gladly send you a copy upon request.





Promising Tests on new asphalt blend

Interesting experiments are now being conducted using gilsonite blended with two Hercules products—Belro* Resin and Abalyn*—as a possible road-surfacing replacement for asphalt. Test sections of asphalt and this new blend have been put down on a major highway. Preliminary reports after 7 months of punishing traffic show that the blend stretch of paving is still in good condition.

This is but one of several Hercules asphalt blends being investigated. Molding materials, joint fillers for concrete and brick roads, asphalt building and construction products, impregnating and laminating compounds, and asphalt-type adhesives and caulking compounds are all under consideration. Write for your copy of the publication "Hercules Asphalt Modifier."

Sorry, Parlon* is not available

Because of the critical situation on rubber, Hercules Parlon is not currently available. This is unfortunate, for many of our good customers report that Parlon has no peer as a base for paint on concrete surfaces, and as a flameproofing compound for canvas and similar materials. However, during the past few months Hercules has been searching for new ways of making Parlon. This new knowledge, together with our past experience, points to a product which not only possesses the superiorities of Parlon but offers even greater advantages.

Life of adhesives more than doubled

Within a comparatively short time after their manufacture, most rubber-base adhesive tapes and similar surgical plasters lose their "stickiness." Today, however, new adhesives are being produced that retain excellent cohesion and adhesion qualities for several years. This prolonged life results chiefly from the use of Hercules Staybelite* (a hydrogenated rosin which effectively resists oxidation) or Stabelite compounds as the resinous component in tape adhesives.

Staybelite also aids color retention of the white tape adhesive masses—reduces the tendency to "creep"—and it helps to maintain tackiness in either hot or cold climates. We shall be pleased to send you additional information.

*Reg. U. S. Pat. Off., by Hercules Powder Company

Plain facts on a flameproofing wax

Here are some facts about Hercules Chlorinated Paraffin, a product which is becoming increasingly important for use in flameproofing coatings.

First, it is uniform in its light color, viscosity, and stability—important factors in color-matching, grinding, and storage.

Second, it will not burn, and forms an essential ingredient of many modern flameproof coatings.

Third, it is very widely soluble and, in addition, it is compatible with most waxes, oils, and resins.

Despite the increasingly widespread application and usefulness of this Hercules product, production is still adequate for all anticipated needs. Write Hercules Powder Company, Cellulose Products Department, for the new Chlorinated Paraffin Data Sheet, just off the press.

"Take a letter, Miss Jones"

Your product problem may possibly be solved by one of Hercules' chemical developments. Write us a letter stating your problem as specifically as possible. We shall gladly share with you available information.

HERCULES POWDER COMPANY
INCORPORATED
92 Delaware Trust Building, Wilmington, Del.

Please send me further information on: ______________________

____

____

Name ______________________

Title ______________________

Company ______________________

Address ______________________

City ______________________ *State* ______________________

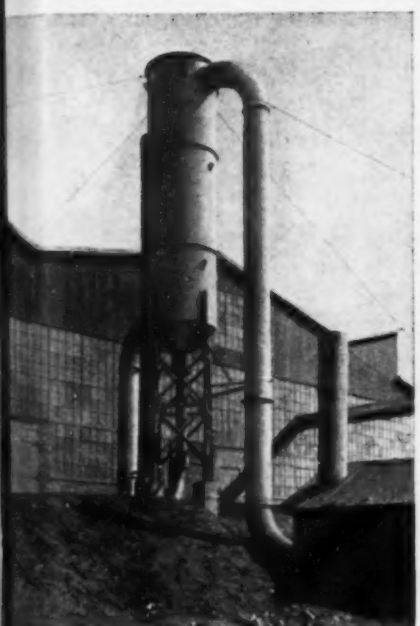
IN-186

USE THE COUPON FOR MORE INFORMATION

CELLULOSE PRODUCTS • ROSIN & TERPENE CHEMICALS
CHEMICAL COTTON • EXPLOSIVES • PAPER MAKERS CHEMICALS • SYNTHETICS

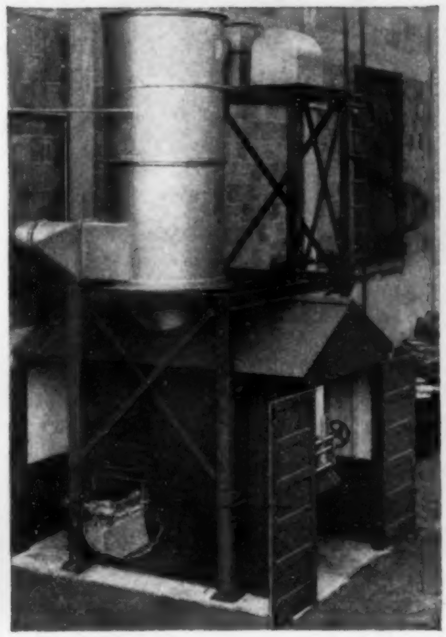
HERCULES POWDER COMPANY
INCORPORATED
WILMINGTON DELAWARE

Multi-Wash Dependability Wins in Three More Plants



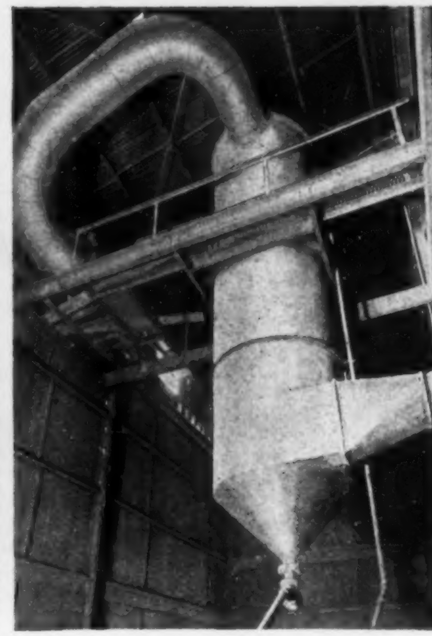
1. *Controlling Odors in a Chemical Plant*

This 4,500 c.f.m. Schneible Senior Collector is used for condensing steam to remove an odor arising from a specialized chemical process. The cooling and washing medium is recirculated. The workers in this plant are no longer handicapped by the noxious odor.



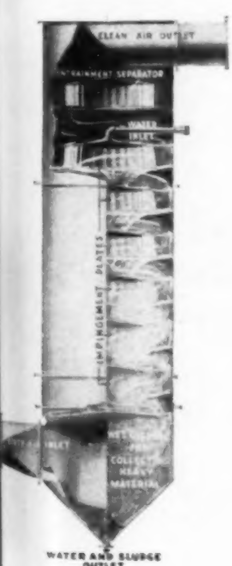
2. *Controlling Fumes in a Printing Ink Plant*

The Schneible Multi-Wash Collector System pictured, installed in a large printing ink plant, eliminates a plant and community nuisance and at the same time recovers valuable oils from the fumes exhausted from varnish kettles.



3. *Controlling Dust in a Lime Plant*

A 10,000 c.f.m. Schneible Multi-Wash Collector removes lime dust from the air exhausted from the hydrator, baggers and other operations in a large lime plant. Working conditions in this establishment were substantially improved and salvaged dust returned to the process system.



Dependable Multi-Wash Collector Systems have scored victories over every dust, odor and fume condition encountered in industry, helping to maintain peak production and salvage valuable by-products in many process plants. They are recovering valuable materials to an extent which often pays for the installation.

Schneible equipment embodies the correct wet-wash principle, which has proved adequate in the toughest cases. There are only two moving parts in the system — the fan and the pump. No attention is required and operation is remarkably maintenance-free. There are no screens, bags or filters — no parts to break, burn, clog or rapidly wear. Water or other cleansing liquid used can be recirculated again and again.

Our engineering staff is prepared to give you real aid in the solution of your dust and fume problems. Write us about them.

CLAUDE B. SCHNEIBLE COMPANY
3957 Lawrence Avenue
Chicago, Illinois
Engineering Representatives in Principal Cities

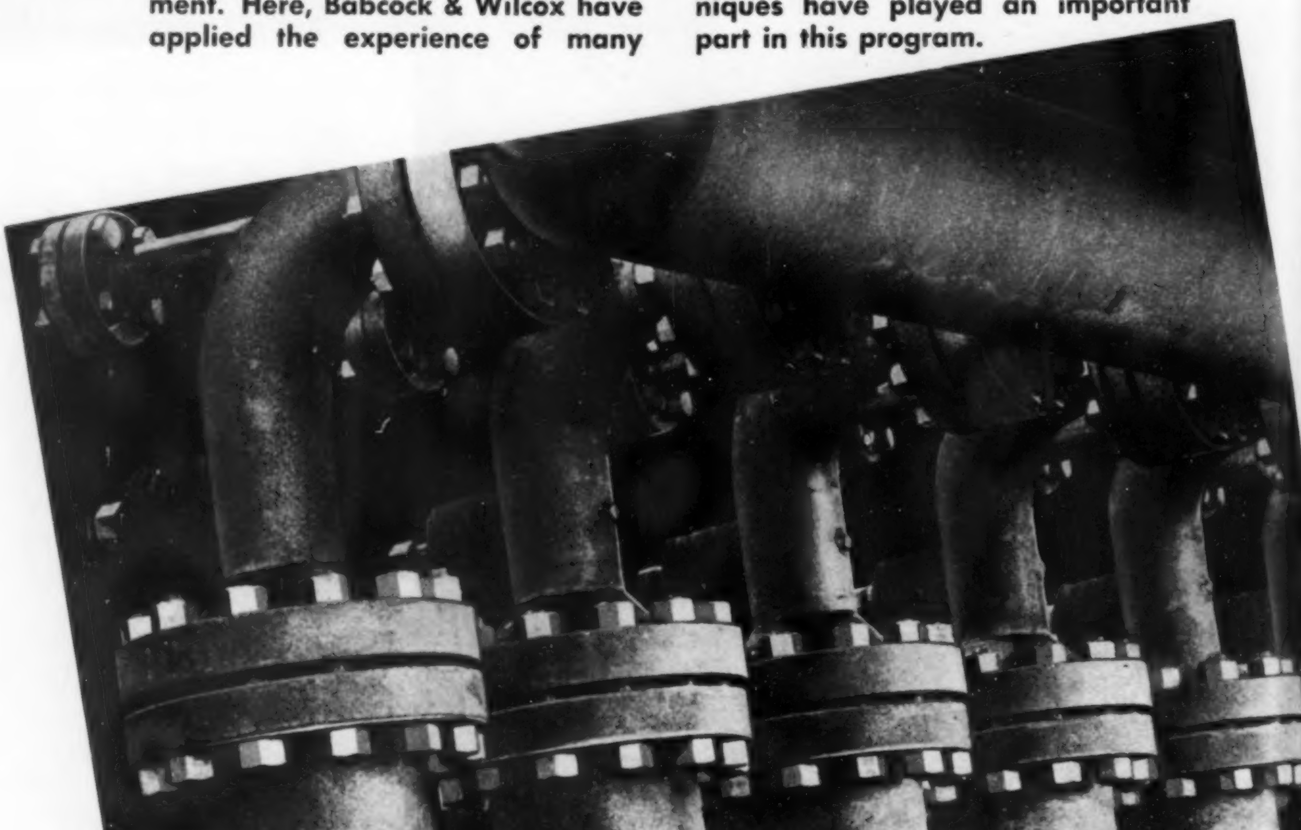
SCHNEIBLE

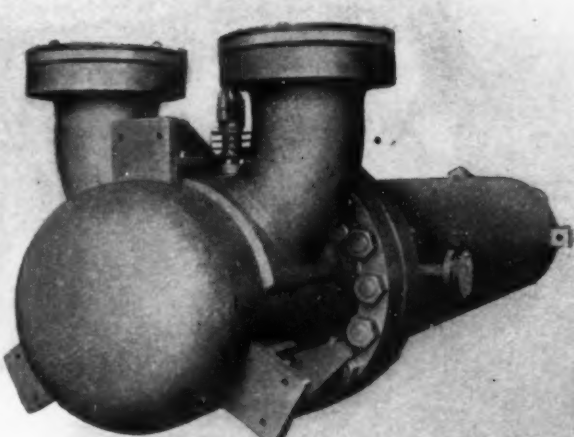
DUST, ODOR AND FUME CONTROL EQUIPMENT

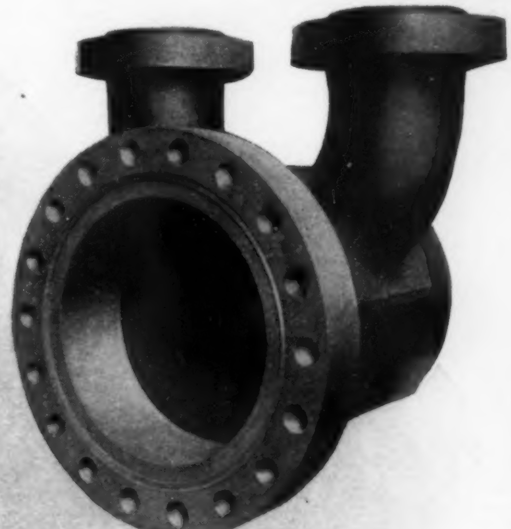
OUT OF THE ORDINARY

Advanced Engineering Designs in Process Equipment Call for Advanced Production Methods

The exigencies of war have brought many important changes—improvements, if you will, in the processing of Oils, Gases, and Chemicals. This has naturally brought about the designing of new processing equipment. Here, Babcock & Wilcox have applied the experience of many years in the manufacture of high-pressure, high-temperature vessels. Each job has presented a new problem in engineering to produce the complicated parts of these vessels. B&W welding and annealing techniques have played an important part in this program.



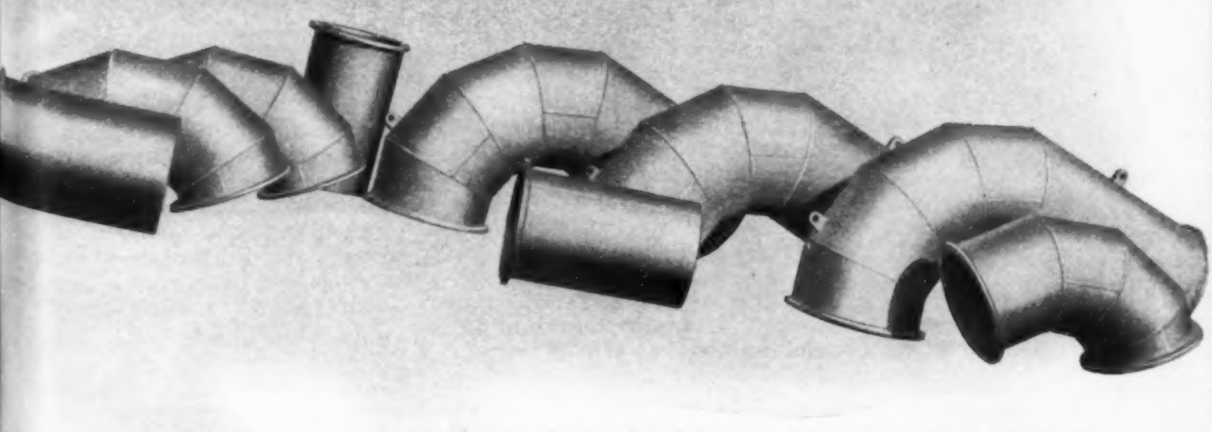




Some Unusual Parts Built by Babcock & Wilcox Shops

This desuperheater, completely assembled, is 21 ft. 4 in. in length in two sections.

The upper and lower sections are bolted together, through flanges, and fitted with nozzles and supports. The lower section of the desuperheater, shown at the right, is formed by welding a flange and a dished head to the shell. This shell was rolled from plate 2 9/32 in. thick and welded longitudinally. The inlet and outlet nozzles are 14 in. in diameter, with walls 2⅞ in. thick, welded to the shell.



he vapor piping shown here was fabricated of alloy steel containing 18% chromium, 8% nickel, with 0.16% carbon maximum. The straight and mitre-sawed joints were all welded by the B&W fusion method.

S-39 T

BABCOCK & WILCOX 85 LIBERTY STREET NEW YORK, N. Y.

Dowtherm provides accurate temperature control

with economy and flexibility

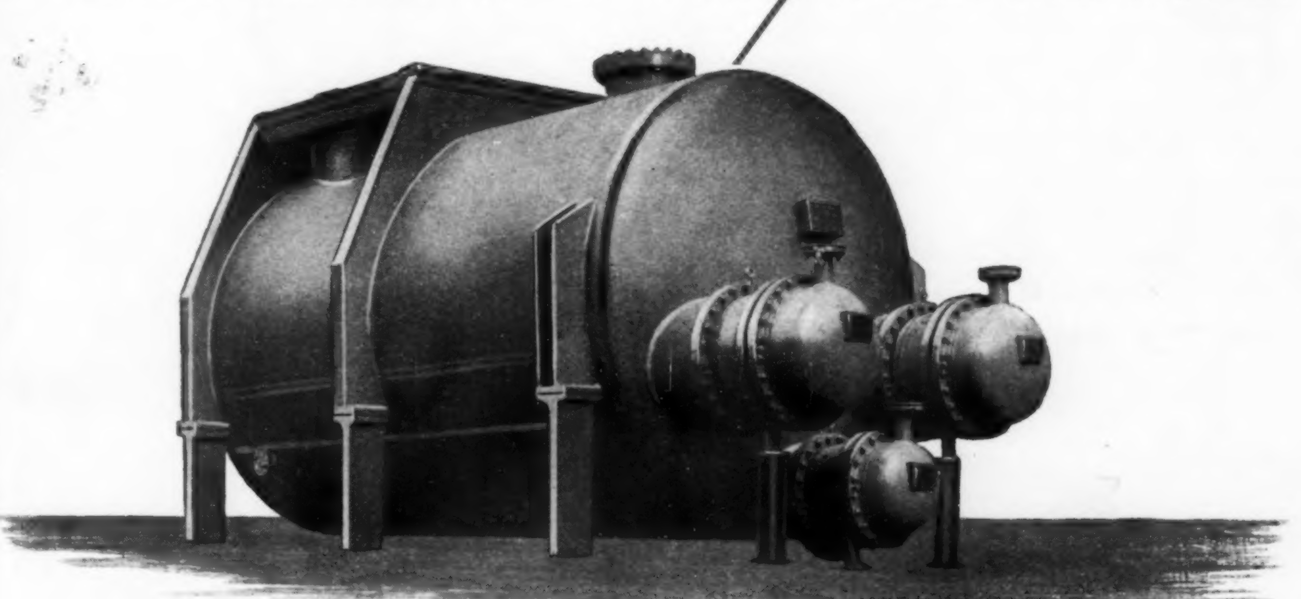
Precision temperature control is essential in the treatment of sensitive oils and for naphtha re-runs. For such service Dowtherm provides a combination of three distinct advantages seldom attained by other methods—accurate temperature control in the range of 400° F. to 725° F.—economy—flexibility.

The unit illustrated is an excellent example of a Dowtherm application—combining economy with flexibility of operation. *Three* different materials—all requiring close temperature control—can be processed simultaneously at *three* different temperatures with low fuel and labor cost, plus large savings in initial equipment expenditure.

This Dowtherm system was constructed for close coordination with a fractionating tower in the reboiling of naphtha and in the treatment of sensitive oils. Its advantages, however, extend to almost any industry confronted with one or more closely allied heat processing applications in high temperature ranges.

THE DOW CHEMICAL COMPANY, MIDLAND, MICHIGAN

New York • Chicago • St. Louis • Houston • San Francisco • Los Angeles • Seattle



DOWTHERM

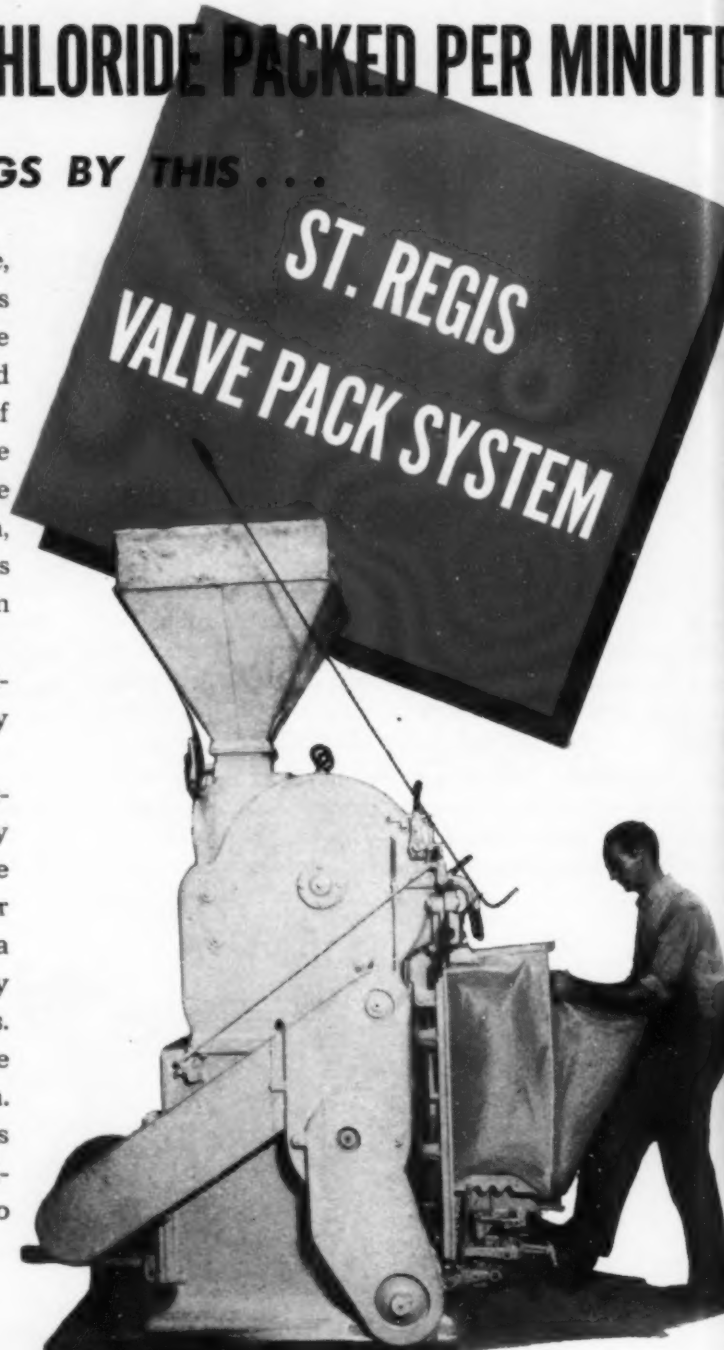
THE HIGH TEMPERATURE, LOW PRESSURE, HEAT TRANSFER MEDIUM

DOW

CHEMICALS INDISPENSABLE TO INDUSTRY AND VICTORY

600 LBS. OF CALCIUM CHLORIDE PACKED PER MINUTE

IN MULTIWALL PAPER BAGS BY THIS . . .



As easily as you shift gears in your automobile, an operator moves the levers of a St. Regis Packer and packs 600 lbs. of Calcium Chloride per minute in Multiwall Valve Bags. Such rapid production is due to the self-closing feature of the Valve Bag, the speed of the Packer, and the fact that the operator does not have to lift the filled bags. St. Regis Bags are strong and tough, and the incorporation of special sheets protects this hygroscopic and deliquescent product in transit and storage.

Calcium Chloride is but one of the 67 chemical products now being packed in sturdy St. Regis Paper Bags.

Free-flowing products are packed economically in Valve Bags with the St. Regis Gravity Type Packer which is a simple, inexpensive unit. Open-mouth bags, closed by sewing or wire ties, are available also, so that there is a St. Regis Packaging System for every company shipping in 25 to 100 lb. units in paper bags.

Our packaging engineers will welcome the opportunity to study your packaging operation. They will develop the proper Multiwall Bags for your products and recommend the most efficient and economical packaging equipment to meet your production requirements.

St. Regis Multiwall Bags are made with multiple independent walls of sturdy kraft paper. They are astoundingly strong, moisture-resistant, and impervious to dust, dirt, or insects. No sifting, clean to handle and store, and they stack well.

MULTIPLY PROTECTION . MULTIPLY SALEABILITY

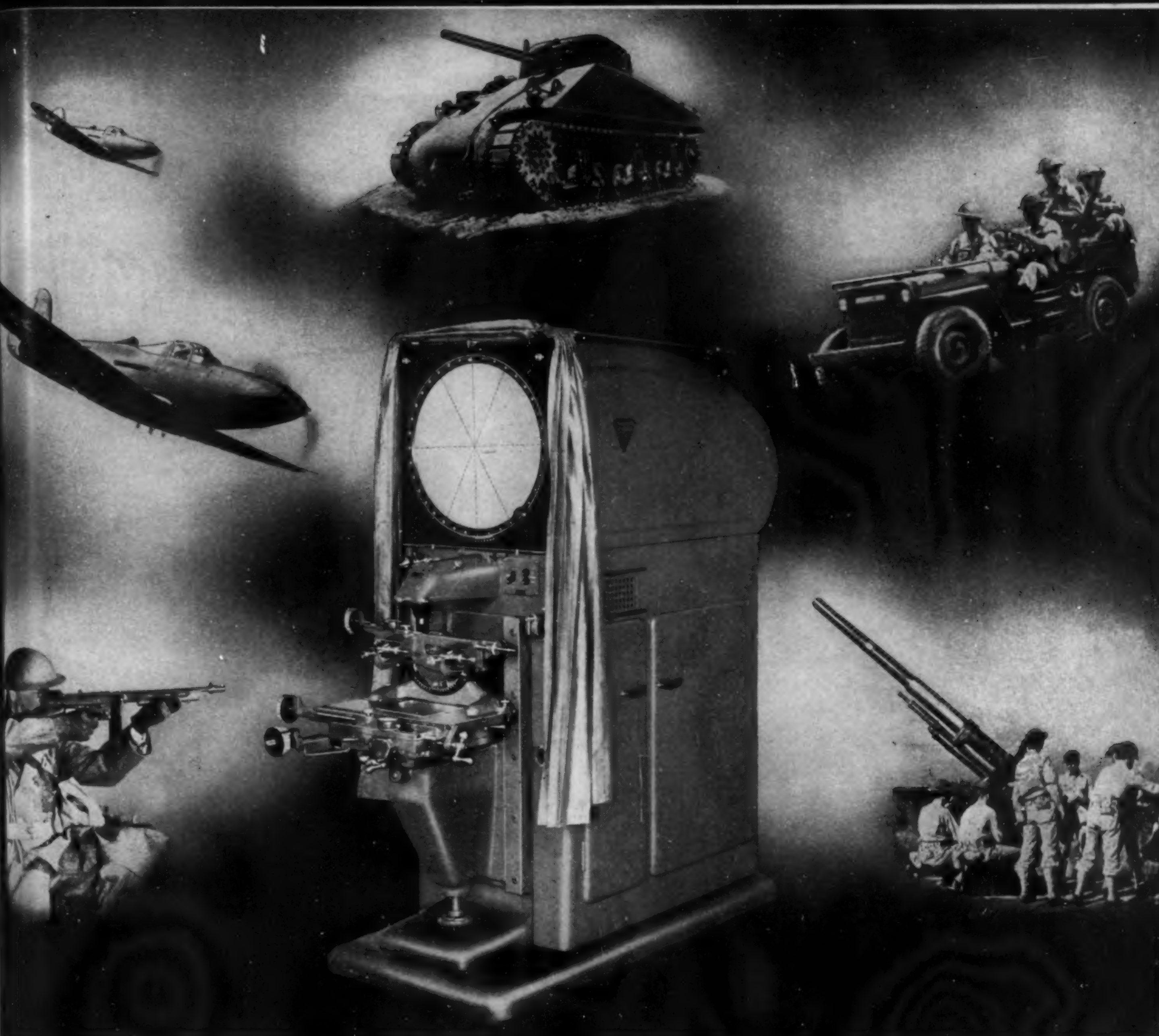
ST. REGIS PAPER COMPANY

TAGGART CORPORATION • THE VALVE BAG COMPANY

NEW YORK: 230 Park Avenue

CHICAGO: 230 No. Michigan Avenue

Offices also at: Baltimore, Md. · Birmingham, Ala. · Dallas, Tex. · Denver, Colo. · Franklin, Va. · Los Angeles, Calif. · Nazareth, Pa. · New Orleans, La. · San Francisco, Calif. · Seattle, Wash. · Toledo, Ohio



Bausch & Lomb Contour Measuring Projector

Today Precision *Must* Be Commonplace

American fighting men on our fighting fronts depend upon production line accuracy . . . for ten-usandths of an inch variation on production line can mean the dif-nce between a hit or a miss on the leline.

he Bausch & Lomb Contour Meas-g Projector makes such accuracy ible on the fastest moving produc- lines, because it takes many vital inspection jobs "off the surface plate" and eliminates the tedious, time-consuming computations of the "sine bar." Inspections for accuracy become routine jobs.

Throwing an accurate, sharply defined shadow image of the object under examination on a translucent screen, the B&L Contour Projector permits exact measurements or comparison with an enlarged template drawing at magnifications great enough for easy and accurate dimensioning.

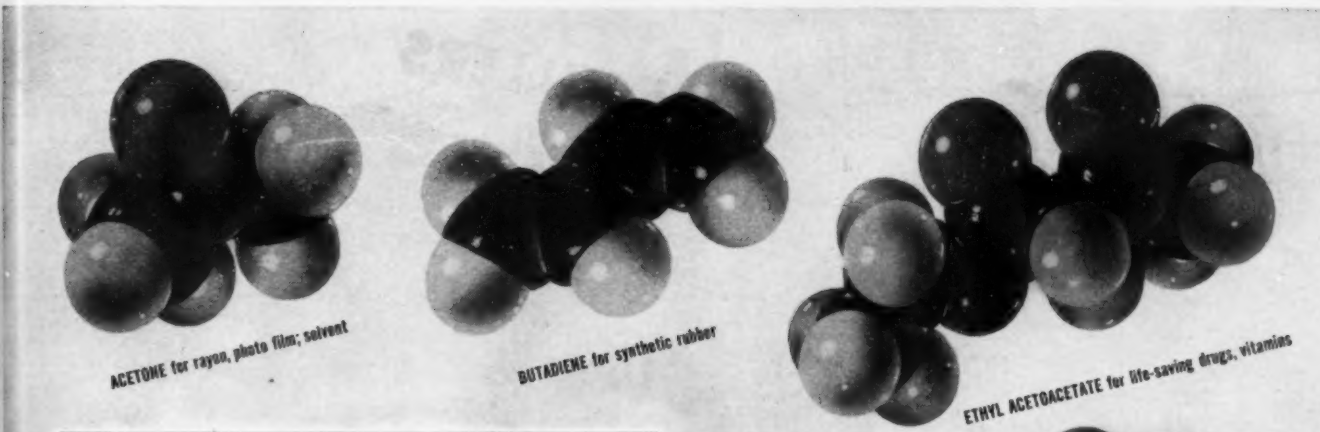
Here again is a Bausch & Lomb peacetime development that serves America at War. The B&L Contour Measuring Projector is helping speed production of fighting tools for our fighting men.

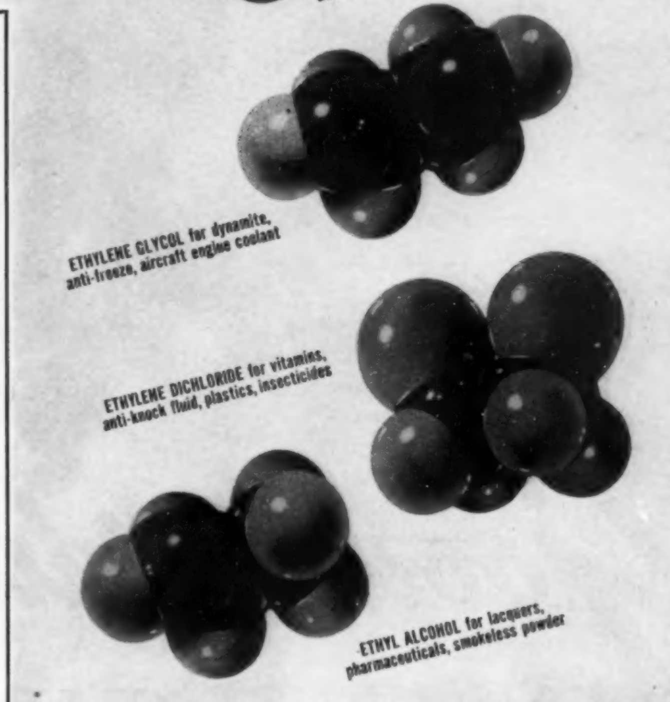
For Bausch & Lomb Instruments essential to Victory—priorities govern delivery schedules.

BAUSCH & LOMB
OPTICAL CO. • ROCHESTER, N.Y.
ESTABLISHED 1853

IERICAN SCIENTIFIC INSTITUTION PRODUCING OPTICAL GLASS AND INSTRUMENTS FOR MILITARY USE, EDUCATION, RESEARCH, INDUSTRY AND EYESIGHT CORRECTION

Electrically-Heated Equipment
• For Accurately-Controlled Temperatures
• At Ranges up to 600° to 800° F
Steam-heated processing equipment for operation at high temperatures must be of much heavier construction than properly designed electrically-heated apparatus. This lighter construction is more economical . . . particularly when special metals are called for. Electric heating is also advantageous when steam at the right temperature is not available and where current cost is low.
For electrically-heated equipment consult us . . . specialists in High Vacuum apparatus, engineers and builders of drying, evaporating, distilling, extracting, impregnating, solvent recovery and other types of processing equipment. Write for catalog.
F. J. STOKES MACHINE COMPANY
5920 Tabor Road Olney P. O. Philadelphia, Pa.
Representatives in New York, Chicago, Cincinnati, St. Louis, Cleveland, Detroit.
Pacific Coast Representative: L. H. Butcher Company, Inc.
F.J.Stokes
PROCESSING EQUIPMENT
FJS Est. 1895





Molecular Keys To A New World

VAST NEW SOURCES of raw materials . . . the equivalent of those which might be found in a great new continent . . . opened to America when CARBIDE AND CARBON CHEMICALS CORPORATION started building synthetic chemicals from water, salt, air, and hydrocarbons.

These chemicals are usually water-white liquids, although some are gases or solids. Basically, they are compounds of carbon and hydrogen—the atoms of which are united with oxygen or with chlorine to build up an endless series of chemicals. The models of those molecules of chemicals shown here are many millions of times actual size.

These chemicals are the raw materials for fabulous plastics . . . amazing textile fibers . . . life-saving drugs . . . vitamins by the carload . . . synthetic rubber . . . more things and better things than were possible before their existence.

Since these chemical wonders are obtained from abundant domestic sources, their use has contributed materially to the nation's self-sufficiency. Through research, American ingenuity, and patient development, scarce natural products have been duplicated or improved upon. Great new industries and great new materials that contribute to the nation's strength have come into being. And America has become a leader in a field as native as its own soil.

Broadly speaking, the uses of many of the synthetic organic chemicals developed by CARBIDE AND CARBON CHEMICALS CORPORATION are just beginning. The already established uses are indicative of their vast future values to mankind.

BUY UNITED STATES WAR BONDS AND STAMPS

MAN-MADE! All types of synthetic rubber require synthetic organic chemicals for their manufacture. Here's hope for tires for you in the future.

COLD PROOF! Coolant for liquid-cooled aircraft engines and base for anti-freeze in military cars and trucks is ethylene glycol, an important synthetic chemical.

MAGIC PLASTICS! Wonderful plastics that look like glass, stretch like rubber, and which are proof against water, sunlight, oils, and many chemicals are made from VINYLITE synthetic resins.

BETTER MEDICINES! Amazing medicines like the sulfa drugs, synthetic vitamins, powerful insect repellents, and anti-malarial drugs depend upon synthetic organic chemistry.

For information concerning the use of these chemicals, address:

CARBIDE AND CARBON CHEMICALS CORPORATION

Unit of Union Carbide and Carbon Corporation

30 East 42nd Street UCC **New York, N. Y.**

PRODUCERS OF SYNTHETIC ORGANIC CHEMICALS

"Vinylite" is a registered trade-mark of Carbide and Carbon Chemicals Corporation.

MAN KILLERS

Eberthrella typhosa, the bacteria that produce typhoid fever, were formerly one of man's most dangerous enemies. Today chlorination has virtually put an end to water-borne typhoid epidemics.

PRODUCTION KILLERS

Bacillus mesentericus is the capsulated slime-forming organism that clogs pipes and valves and hampers heat transmission in cooling equipment. Today proper water treatment prevents losses due to this cause in hundreds of progressive plants.

Good Riddance to both

thanks to CHLORINATION

Production often is cut down because the industrial water supply is contaminated by slime-forming organisms. Slime deposits reduce the flow of water through pipes and valves, while coatings of slime in cooling systems retard heat transmission. In other cases, quality of finished product may be seriously affected by these organisms.

Hundreds of plants are protecting themselves against such losses by chlorinating their water with W&T equipment. Chlorination destroys such organisms and prevents their further growth.

Whenever you have any probem occasioned by the bio-fouling of water, let Wallace & Tiernan Engineers, from over a quarter of a century of experience in water purification, suggest the most practical and economical method to overcome it. Why not call W&T today?

CM-10

ARMY E NAVY

WALLACE & TIERNAN CO., Inc.

MANUFACTURERS OF CHLORINE AND AMMONIA CONTROL APPARATUS
NEWARK, NEW JERSEY • REPRESENTED IN PRINCIPAL CITIES

WORTHINGTON
QD QUICK DETACHABLE SHEAVES

Installing a 48" PD "C" section 8 groove QD Sheave on a 7" stroke horizontal air compressor. The QD Sheave weighs 440 pounds, four times the girl's weight.

NOW AVAILABLE for DriveN as well as DriveR applications

Women assembling GIANT DRIVEN SHEAVES, no longer are an oddity to be headlined in Ripley's "Believe It Or Not." INEXPERIENCED "GREEN" HELP in assembly plants find these sheaves simple to mount.

The problems of assembling and maintaining Vital DriveN and DriveR machinery have been greatly simplified with the introduction of the Worthington patented QD Sheave with its "Easy To Get On—Easy To Get Off, YET ALWAYS TIGHT ON THE SHAFT" features.

The QD Sheave design has now been incorporated into a complete range of DriveN and DriveR sizes that will accommodate 10,000 drive combinations up to 150 horsepower from stock.

One demonstration will convince you that a wrench and inexperienced hands are all that are needed to install or remove a QD Sheave, regardless of size. Arrange for your demonstration today—write or call the Worthington Multi-V-Drive dealer or the Worthington District Office in your territory.

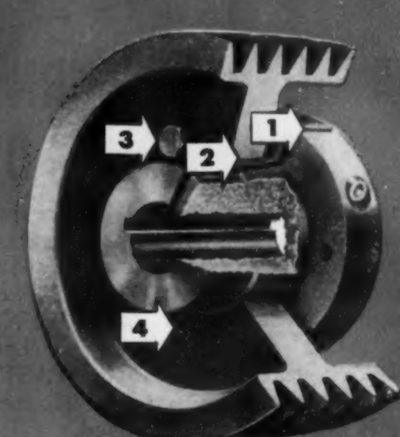
MV3-10

WORTHINGTON MULTI-V-DRIVES

COMPLETE DRIVES · SHEAVES OR BELTS ONLY

WORTHINGTON PUMP & MACHINERY CORPORATION · GENERAL OFFICES: HARRISON, N. J.

Superior Advantages of the QD Sheave Design Cost No More



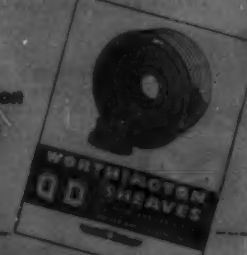
1 **Split Hub** for easy mounting or removal from the shaft.

2 **Tapered Fit** between split hub and rim for easy mounting or removal of rim from hub.

3 **Pull-up Bolts** which hold the rim onto tapered split hub for tapered friction drive assembly and positive press fit on the shaft.

4 **Tapped holes** in rim for using pull-up bolts as jack screws to free the tapered friction fit when detaching the rim.

Mail the Coupon NOW for this New Bulletin



I would like more information about the Time, Labor, and Material Saving Advantages of the Worthington QD Sheave.

Name ______ Title ______

Company ______

Address ______

City ______ State ______ County ______

Product Manufactured ______


SQUEEZ-GRIP
Sensationally New!
C-O-TWO
Latest Portable Release for Quick Action Against Fire
From the time C-O-TWO originated the idea of using the tremendous pressure of carbon dioxide stored in cylinders and developed the now famous pressure operated release for multiple cylinder fire extinguishing systems, the development of new equipment has been a day in and day out task of C-O-TWO engineers.
NEW SQUEEZ-GRIP SAVES TIME AND GAS
C-O-TWO has scored again, by developing a C-O-TWO pressure-sealing valve. The release lever is directly over the carrying handle so that the valve may be easily opened or closed while carrying the extinguisher. No need now to set the extinguisher down to open or close the valve —there's no "handwheel" to be turned. The new SQUEEZ-GRIP releases carbon dioxide gas as quickly as you can close your hand. It's as fast as a Tommy gun and flattens fire in seconds without damage to materials or equipment.
C-O-TWO is a registered trademark and corporate name of this company. C-O-TWO is inspected and labeled by the Underwriters' Laboratories; approved by Factory Mutuals, and the Bureau of Marine Inspection and Navigation. To be safe specify C-O-TWO
C-O-TWO FIRE EQUIPMENT COMPANY
NEWARK, NEW JERSEY
Sales and Service in the Principal Cities of United States and Canada

BEFORE THESE THINGS CAN HAPPEN . . .

Making explosives, like making high-octane gasoline and so many other items demanded for war, is a chemical process involving large quantities of corrosive liquids. Acids must be manufactured, loaded and unloaded, transferred from tank to vat. Those corrosive liquids must be moved quickly, safely, dependably . . . if there are to be bombs for Berlin and TNT for Tokyo.

The fact that LaBour Pumps are doing the major portion of that moving job in American chemical plants is important to the future buyer of chemical pumps only because today's performance is a positive test of inbuilt quality. LaBours are making good under the toughest conditions it is possible to impose. That is why LaBour facilities are devoted completely to the war effort; that is why manufacturers of civilian chemicals cannot get LaBour Pumps now.

Out of this severe period of test will come even better LaBour Pumps for tomorrow, for we never stop learning. In the competitive business world that will come with peace, efficient pumping of chemicals will be at a premium just as today—and LaBours will do the job with the same economy and dependability that mark their performance in war.

LaBour Type Q, a new design centrifugal for lasting efficiency where priming ability is not required.

LaBour Type DPL, the centrifugal pump that primes itself.

THE LaBOUR COMPANY, Inc.
Elkhart, Indiana, U. S. A.

LaBOUR PUMPS

LaBour


A Big Mixer
for a
BIG JOB
MATERIAL HANDLING
PILOT PLANT MIXER
LABORATORY MIXER
BLENDING & MIXING
PLANETARY MIXING
READ Chemical Processing Equipment

BARDOL* in BUNA S *. . . Tests hav*

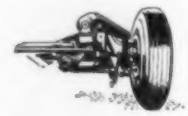
shown that Bardol is completely compatible with Buna S (GR-S), processing readily. It functions as a wetting agen and is also an effective plasticizer.

. . . Bardol promotes dispersion of sulphur and accelerator in the elastomer, thereby improving behavior and perfor mance of the compounds. Users have found that when in corporated in appropriate amounts, Bardol contributes to

GREATER RESILIENCE  ***AND LOWER HYSTERESIS***

IMPROVED RESISTANCE TO ABRASION 

 ***HIGH TENSILE STRENGTH AND ELONGATION***

LOW PERMANENT  ***AND COMPRESSION SET***

FLEXIBILITY AT LOW TEMPERATURES, RESULTING IN

GREATER RESISTANCE  ***TO PLY SEPARATION***

For complete details, wire or write

THE BARRETT DIVISION

ALLIED CHEMICAL & DYE CORPORATION

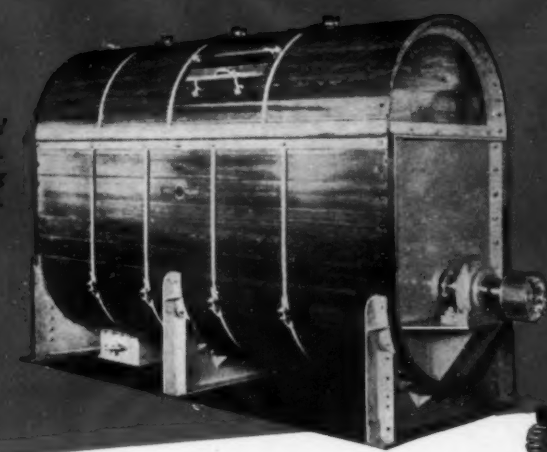
40 RECTOR STREET, NEW YORK

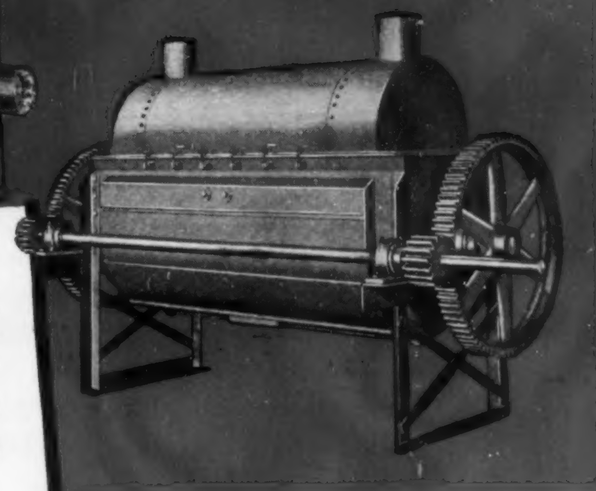
*Reg. U. S. Pat. Off.

ONE OF AMERICA'S GREAT BASIC BUSINESSES . . .

Barrett

ntal batch-type mixer with wood used in manufacture of yeast. wood-body mixers are speeding tion and saving critical metals.





Special jacketed mixer with vented dome cover. Such mixers are engineered to individual needs.

THE VARIETY AND VERSATILITY OF SPROUT, WALDRON MIXERS
elp solve new processing problems

THE constant changes in our chemically processed products, emphasize the part which SPROUT, WALDRON Mixers and other processing machines can play in the speedy and economical preparation of urgently needed materials.

The wide range of mixers includes standard batch and continuous types in both vertical and horizontal models, and literally hundreds of others, custom built to meet the requirements of special processes—often combining several steps, like sifting, grading or blending, with mixing.

Other SPROUT, WALDRON equipment used by chemical processors includes rotary knife cutters, crushers, shredders, grinders, attrition mills, dust collectors, conveyors and elevators.

When you bring your problem to SPROUT, WALDRON you will get, besides 77 years of experience, the benefit of a versatile, ingenious engineering staff that will study it from all aspects so that preparative and sequential steps may be combined for synchronized production.

Write for Bulletin 1234—a compact description of SPROUT, WALDRON Process Equipment.

★

★

One of several types of standard sifting mixers. Available in sizes down to laboratory units.

SW

SPROUT, WALDRON & COMPANY

Manufacturing Engineers since 1866

143 SHERMAN STREET MUNCY, PENNSYLVANIA

THE TURBO-MIXER CORPORATION

247 Park Ave. New York, N. Y.

Turbo-Equipment for solving the more difficult problems in the mixing of liquids with liquids, solids and/or gases.

The Turbo-Mixer Corporation devotes itself exclusively to solving the more difficult problems of mixing liquids with other liquids, solids, and/or gases by means of a careful diagnosis of each case, interpreted by a staff of experienced chemical engineers. The soundness of approaching mixer design from the chemical engineering viewpoint has been amply demonstrated by the achievements of Turbo-Mixers in the process industries. Our daily experience in solving the mixing problems of many unrelated industries enables us to apply knowledge gained in one industry to another.

Every effort is made to embody in Turbo-Mixers the most modern approved principles of machine design and to use the best materials available for each part.

CONTROLLED AGITATION

Thorough circulation of the charge is assured. It may be gentle or violent as required, gases may be introduced with or without compressors or blowers, dependent on operating conditions, and the time of contacting the reagents under agitation may be accurately governed.

CHARACTERISTIC FEATURES

Either one or more impellers, open or closed, may be used; they may be horizontal or tilted; driven from above or below; and located either on the central axis of the tank or off center. In some applications, stationary deflecting blades are desirable. In all cases the selection of the proper type, number, and location of the impellers, as well as the speed of rotation, are critical factors.

Turbo-Impellers circulate from 50 to 30,000 gallons of solution per minute to give the proper action in tanks up to 500,000 gallons capacity. The use of multiple impellers on the shaft gives even greater recirculation.

ADVANTAGES

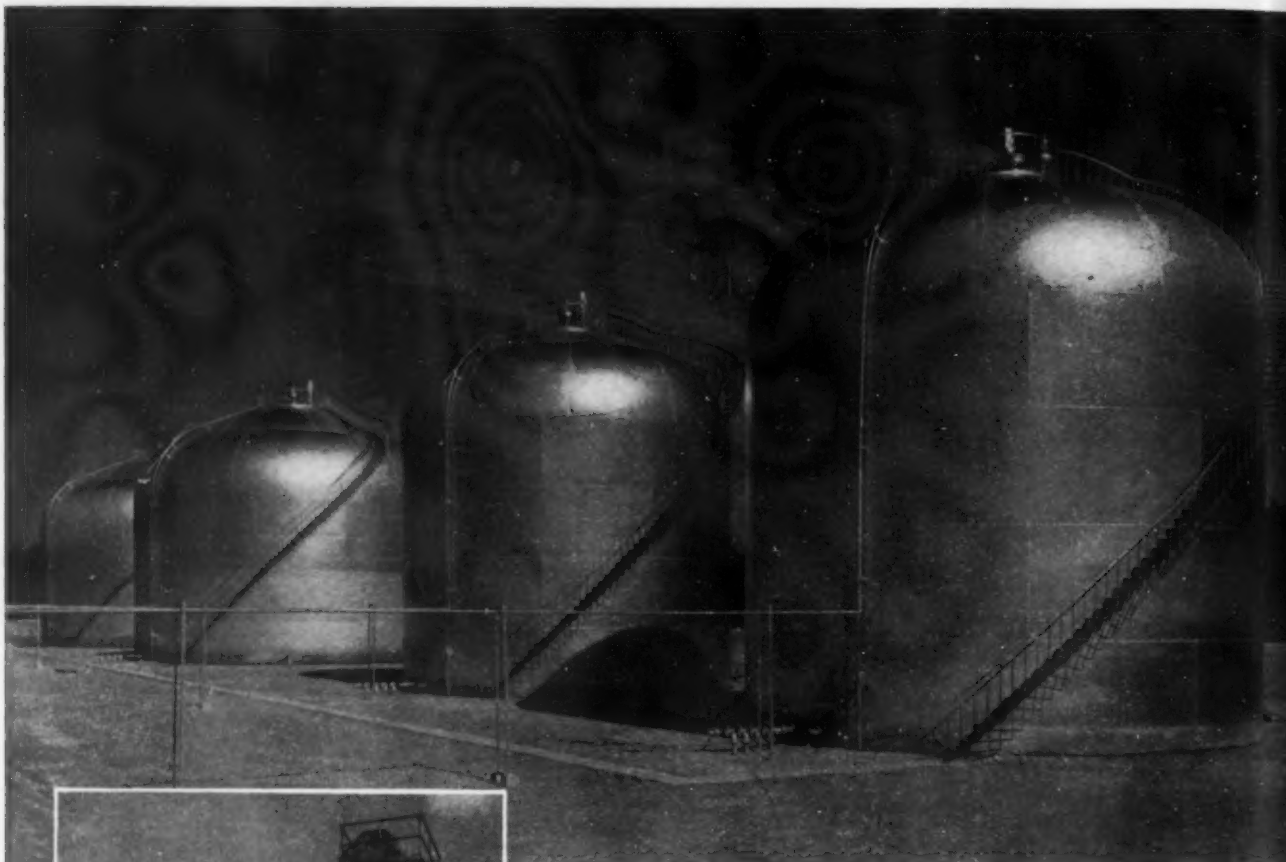
Turbo-Mixers are suitable for either batch or con tinuous operation. They will efficiently mix miscib liquids of all viscosities from 1 to 400,000 centipoise and uniformly blend immiscible liquids throughout th above viscosity range. Their advantages have bee demonstrated in the mixing of liquids with gases, as i solutions of gases in liquids, hydrogenation, oxidation etc.; and in mixing liquids with solids for suspension precipitation, dissolving, crystallization, dispersion, et

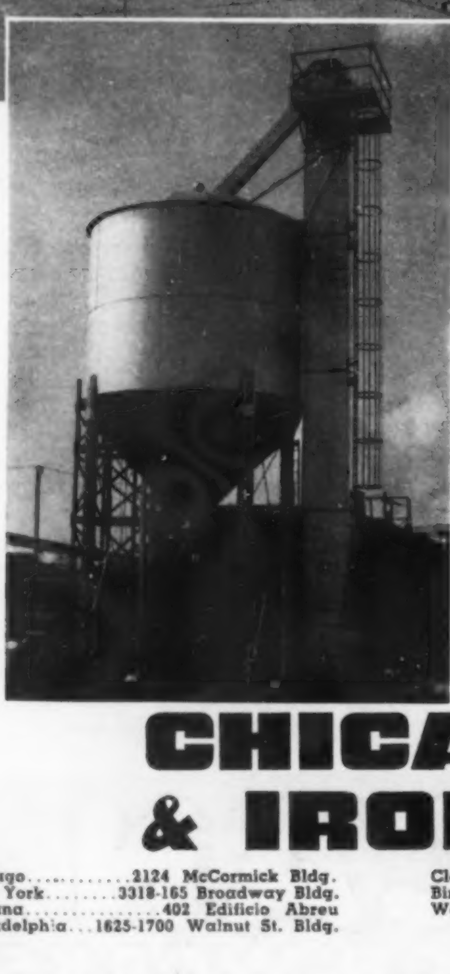
In the various forms in which Turbo-Mixers hav been developed, the following specific advantages hav been obtained:

(1) Better Mixing
(2) More Uniform Product
(3) More Complete Dispersion
(4) Reduced Power Consumption
(5) Perfect Circulation
(6) Reduced Mixing Cycle
(7) Increased Reaction Rates
(8) Increased Capacity
(9) Efficient Gas Absorption
(10) Assured Continuity of Service
(11) High Rate of Heat Transfer
(12) Simplification of Process

These advantages lead to such direct benefits as lowe operating costs, savings in number and size of tanks, re duction of floor space required, minimum material i process, increased output, improved quality of products

SOLVING STORAGE PROBLEMS





...for Today's Industries

PLAIN and complicated storage problems encountered in the production of wartime products are met and solved with tanks such as these. Above are four Hemispheroids used for the storage of distillate at a petroleum recycling plant. Two have capacities of 10,000 bbls. each and the others have a capacity of 20,000 bbls. each. Pressure storage such as this protects the products stored from vapor loss and deterioration. Another type of storage tank is shown at the left. It is a typical conical-bottom steel tank installed at a paper mill for lime storage. It has a capacity of 5,000 cu.ft.

These tanks are but two of many types of storage tanks fabricated at our plants for wartime uses. Others include pressure vessels, Hortonspheres, Hortonspheroids, various types of storage bins and steel reservoirs.

CHICAGO BRIDGE & IRON COMPANY

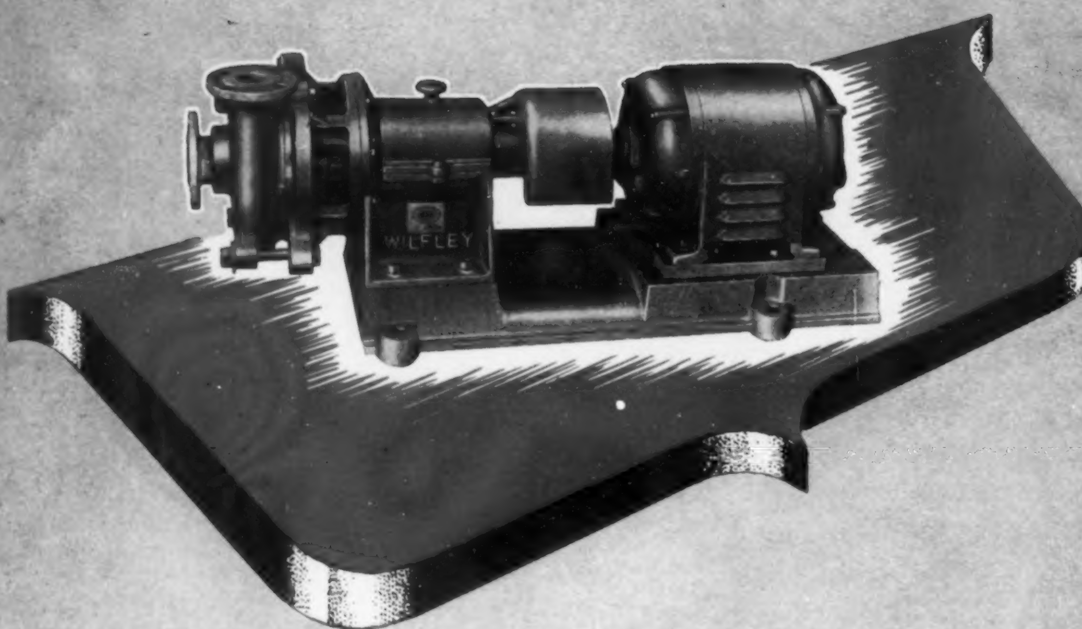
Chicago..............2124 McCormick Bldg.
New York........3318-165 Broadway Bldg.
Havana..................402 Edificio Abreu
Philadelphia...1625-1700 Walnut St. Bldg.

Cleveland............2220 Guildhall Bldg.
Birmingham..........1510 North Fiftieth St.
Washington...............330 Bowen Bldg.

Houston..................5603 Clinton D
Tulsa........................1623 Hunt B
Greenville.........................York S
San Francisco............1022 Rialto B

Plants in BIRMINGHAM, CHICAGO and GREENVILLE, Pa. *In Canada:* HORTON STEEL WORKS, LIMITED, FORT ERIE, O

Chemicals... ON THE MOVE!



In plants where acids, corrosives, hot liquids, mild abrasives and other hard-to-handle solutions MUST flow day and night to keep production at the peak, you'll find the WILFLEY Acid Pump on the job. This is the pump without a stuffing box—therefore the pump that's free from stuffing box troubles. A 'round-the-clock performer on both continuous and INTERMITTENT operations. Effective sealing blades, no rubbing contact. 10- to 1,000-G.P.M. capacities. 15- to 125-ft. heads and higher. Individual engineering service. Buy WILFLEY for increased production without interruption. Write for details.

WILFLEY

A. R. WILFLEY & SONS, INC., DENVER, COLORADO, U. S. A.
NEW YORK OFFICE: 1775 BROADWAY, NEW YORK CITY

DIRECT DRIVE • BELT DRIVE • UNITARY • ACID PUMPS

2 ways
to clean Turbines

1 This way's always a lot of work

Safe cleaning practice. When turbines have operated on oil that has developed excessive sludge and acidity, all trace of contaminants should be removed before refilling. Any contaminants left in the system will speed up deterioration of the new oil. Here are highlights of safe practice:

1 Completely drain the system of old oil.

2 Remove the oil cooler and completely clean it of deposits and old oil.

3 Clean the oil reservoir and precipitation tanks.

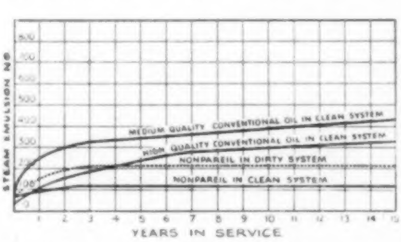
4 Remove bearing caps and end plate, and clean recesses in and around bearings and pedestals.

5 Clean screens and filter or centrifuge.

6 Examine piping layout to determine if it will completely drain. If there are low places or pockets, open up pipe joints at suitable places to insure complete drainage. If possible, pipes should be wiped by drawing rags through them.

7 Clean the governor mechanism, bleeder valve operating mechanism, and oil-operated throttle. It is usually necessary to remove hand plates to insure complete cleaning of the pockets and recesses in the governor mechanism.

All who are familiar with turbine operation know that the foregoing is a bare outline of necessary steps which involve many hours of labor and down time.



Above chart shows that the S. E. number of Nonpareil Turbine Oil remains fairly constant in service, while that of conventional turbine oils tends to increase, due to acidity and sludge. The two lower lines show the advantage of thoroughly cleaning a turbine before installing new oil.

2 This way you do the work only once

Use Nonpareil Turbine Oil, and you need clean your turbine only once—at the time of the original fill.

Why Nonpareil keeps turbines clean. Turbines need cleaning if and when they develop excessive deposits in the oil system. Basic cause of such deposits is oxidation—the absorption of oxygen by certain unstable hydrocarbons in the oil. There are two main types of these unstable hydrocarbons—one forms asphaltenes, the other, organic acids.

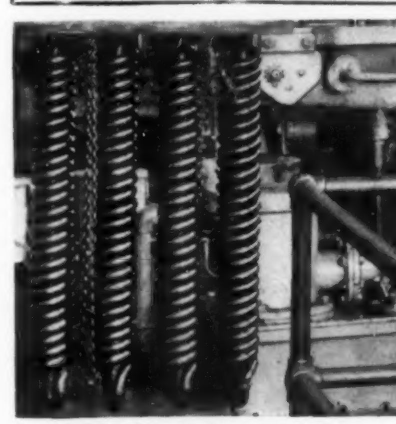
In the refining of Nonpareil, all of the asphaltene-forming hydrocarbons are removed—which completely eliminates this type of deposit. This statement can be made about very few oils.

We know of no refining process that will remove *all* acid-forming hydrocarbons. But we render them permanently harmless in Nonpareil by the addition of a patented inhibitor. This lets us guarantee the neutralization number of Nonpareil never to exceed 0.15 for the life of the turbine. In actual service, it is more likely to be around 0.05, as hundreds of turbines have proved after 5 to 15 years of operation. *This* claim can be made for *no* other oil.

Thus, with the two basic causes of deposits removed, Nonpareil stays clean—retains its new-oil condition. Use it, and you'll never again need to clean your turbines.

A Standard Lubrication Engineer will gladly furnish details, service records, and other proof. Just write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago, Illinois, for the Engineer nearest you.

OIL IS AMMUNITION . . . USE IT WISELY

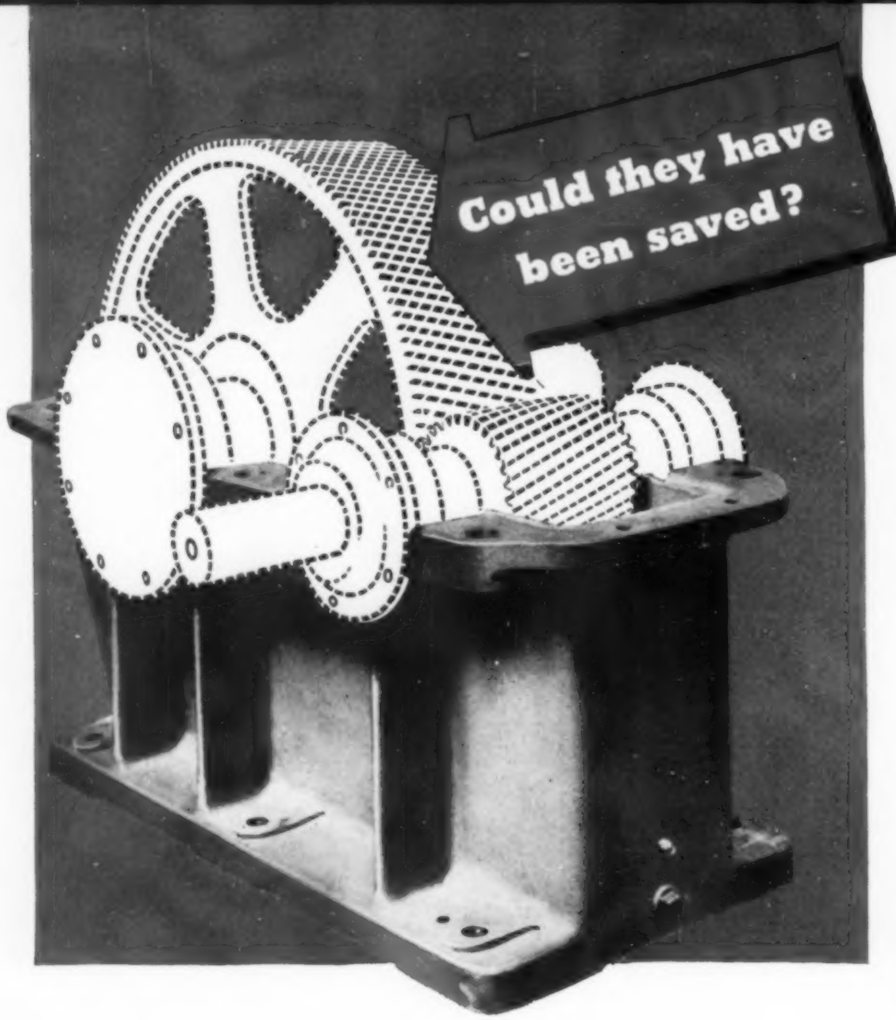


Unretouched photograph showing cooler coils from a steam turbine after 10 years of operation on the same batch of Nonpareil Turbine Oil without change. Note cleanliness.

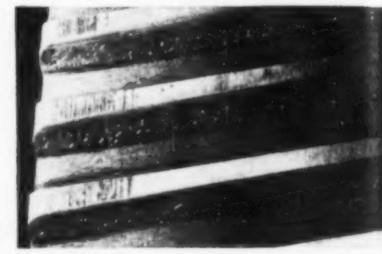
NONPAREIL TURBINE OIL

STANDARD OIL COMPANY (INDIANA)

★ LUBRICATION ENGINEERING



Typical examples of gear wear



Pitting is of two types: (1) Corrective pitting—occurs when gears are first operated, caused by high spots in gear finish. When high spots are eliminated pitting stops. (2) Destructive pitting, illustrated above—occurs when pitting continues until the contacting surfaces are destroyed.

Watch for signs of pitting on new gears. Prevent it from reaching the destructive stage by truing up contact surfaces and applying more effective lubricant.

Abrasion: Generally distinguished by radial scratches on the teeth. In enclosed gears, use greater care in handling lubricants and filling gear cases to prevent entrance of grit and dust. On open gears in dusty conditions, use non-sticky gear compound to reduce abrasion.

Scoring and galling: Different degrees of the same type of wear. Scoring is scratching, grooving, or roughening of tooth surface. Galling, shown above, is seizing or tearing of the surface as the result of continued scoring. Causes: Excessive pressures, rough surfaces, foreign matter, or inadequate lubrication. Analyze any scoring, and correct it before galling occurs.

These are but a few examples. A Standard Lubrication Engineer can help you determine the cause of many types of gear failure and suggest ways to prevent them.

Gear wear and what you can do to reduce it

GEAR WEAR is described by many terms—pitting, spalling, scoring, galling, scuffing—but by any name it all adds up to high maintenance, lost machine time, and replacement headaches.

Today, much of your power transmission equipment is operating at full-load—if not overloaded. That means, first, that more frequent inspections are needed, particularly on enclosed gears and bearings, to detect wear before serious damage is done.

Second, these new operating conditions may require more frequent lubricating schedules or even new types of lubricants. It's a good time to check these points thoroughly before they show up in excessive wear.

Signs of gear wear, and the cause, are easily recognized in many instances. A few are pictured and described at the right. But determining the cure is not always simple.

Why not do the whole job at once—check equipment for excessive wear, check lubricating schedules and lubricants—by having a Standard Lubrication Engineer help you make an inspection of this equipment. He has done this in other plants and has made many valuable suggestions. It will take very little of your time and will cost you nothing. Call any local Standard Oil Company (Indiana) office, or write 910 South Michigan Avenue, Chicago, Illinois, for the Engineer nearest you. In Nebraska, call any Standard Oil Company of Nebraska office.

OIL IS AMMUNITION . . . USE IT WISELY

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

RICATION ENGINEERING...LUBRICATION ENGINEERING...LUBRICATION ENGINEERING...LUBRICATION EN

OUR JOB FOR 1943

Our first "order of the day" during 1943 is — PRODUCE MORE AUTOMATIC CONTROL EQUIPMENT for the merchant marine, the navy, the synthetic rubber and aviation gasoline programs, and other critical war-time requirements. Fisher Automatic Controls occupy a key position in the fulfillment of these and many other war production schedules.

This equipment is necessarily receiving first attention in our plant — it is a "must" obligation to the production drive for victory. As a result we are unable to make delivery on your orders as quickly as in the past.

However, we have taken definite steps to improve the situation and the results are already apparent. We point with pride to these accomplishments — all aimed at PRODUCING MORE AUTOMATIC CONTROL EQUIPMENT IN 1943!

INCREASED PRODUCTION

Already Fisher production is 100% above 1942. Our round-the-clock work schedules call for three eight-hour shifts seven days every week.

INCREASED PERSONNEL

Today, the largest working force in the history of our company is constantly striving to produce Fisher Control Equipment in record-breaking quantities. Every member of our organization is mindful of the job that confronts us and is pledged to do something about it.

INCREASED PLANT FACILITIES

The entire Fisher Plant is "streamlined" to producing more essential control equipment. More floor space — relocation of departments and equipment have made possible more efficient manufacturing methods as well as greater production.

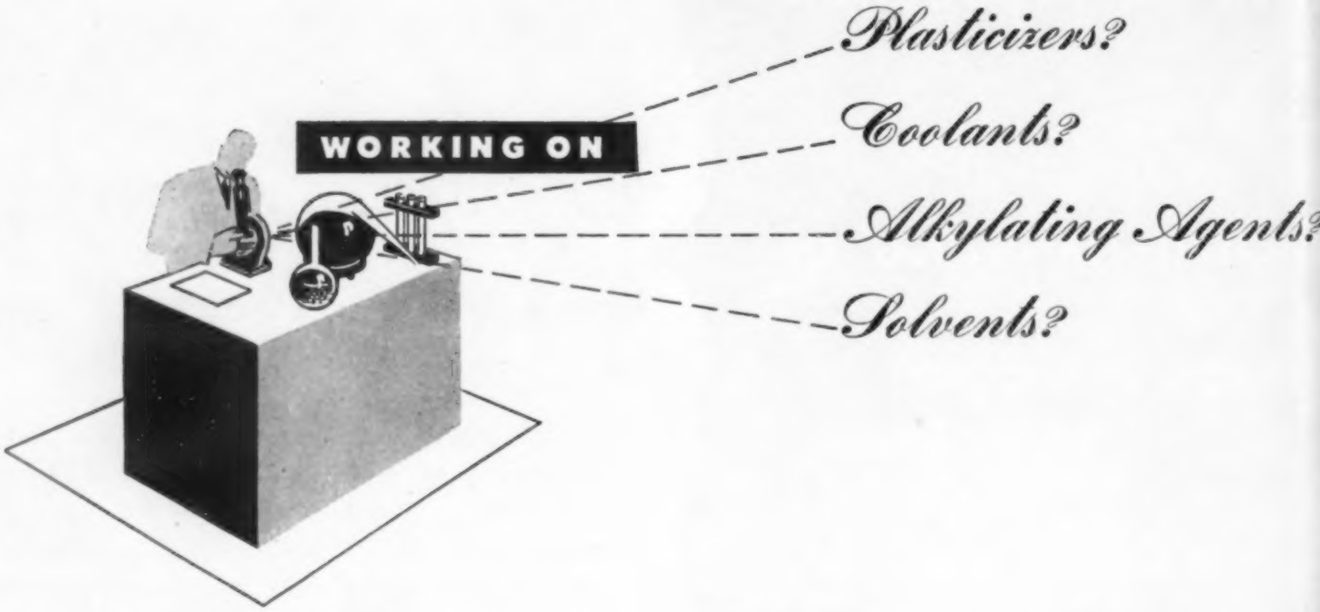
INCREASED MACHINE CAPACITY

To an already impressive and modern array of manufacturing equipment, many latest design machines have taken their place in Fisher production lines to further speed delivery of automatic controls. Materials and workmanship are maintained to Fisher's high standards.

SIMPLIFICATION OF TYPES AVAILABLE

Elimination of many types from the Fisher line for the duration means faster delivery on standard types. Should you order a discontinued item, we ask your co-operation in accepting the recommended standard design . . . remembering that Fisher guarantees satisfactory performance regardless of the substitution.

FISHER GOVERNOR COMPANY
•1814 FISHER BUILDING•
MARSHALLTOWN, IOWA



THIS NEW SERIES OF ORGANIC PHOSPHORUS COMPOUNDS MAY PROVE HELPFUL . . . . .

Here is a new series of organic phosphorus compounds that may prove helpful in the applications indicated above. Properties . . . tabulated below . . . have recently been determined by Victor Research Chemists. Perhaps one of these compounds may meet your exact requirements.

Because of present limitations in the supply of certain critical materials, samples of these and other Victor Research Chemicals announced from time to time, are not always available. Those that are will be sent promptly upon request. Some of the Victor Phosphorus Compounds . . . for which research has established important uses in essential war production . . . are already available in commercial quantities.

VICTOR TRIALKYL PHOSPHATES R_3PO_4

SPECIFICATIONS AND PROPERTIES

COMPOUND	Sp. Gr. at 25° C	Boiling Range at 20 mm.	Melting Point °C	Titn *	Flash Point	SOLUBILITY ** A†	B†	C†	D†	E†	F†	G†
Trimethyl Phosphate	1.217	85-90°C	—45°	<0.1	>350°F	S	S	S	S	S	S	I
Tri-n-propyl Phosphate	1.012	135-140°C	Fluid at —80°	<0.1	>300°F	I	S	S	S	S	S	S
Tri-n-amyl Phosphate	0.947	195-200°C	Viscous at —80°	<0.5	>300°F	I	S	S	S	S	S	S
Trioctyl Phosphate	0.930	—	Very viscous at —80°	—	>300°F	I	S	S	S	S	S	S

*cc 0.1 N NaOH/10 cc sample ** S = soluble; I = insoluble.

A†—Water, B†—Alcohol, C†—Acetone, D†—Ether, E†—Toluene, F†—CCl_4, G†—Naphtha.

ARMY E NAVY

VICTOR *Chemical Works*

HEADQUARTERS FOR PHOSPHATES • FORMATES • OXALATES

141 W. JACKSON BLVD., CHICAGO, ILL., NEW YORK, N. Y., KANSAS CITY, MO., ST. LOUIS, MO., NASHVILLE, TENN., GREENSBORO, N. C. PLANTS: NASHVILLE, TENN., MT. PLEASANT, TENN., CHICAGO HEIGHTS, ILL.

He gets his second breath from a deep-drawn cylinder

The oxygen cylinder shown below is another example of the way the Hackney deep-drawing process is conserving materials, man-hours and equipment—and is producing improved products.

High above the clouds, deep-drawn cylinders containing oxygen aid pilots to breathe easily. To meet the necessarily stringent requirements, these cylinders must be light in weight and have high tensile strength.

Hackney Cylinders, Drums and Barrels

Products like the one described above keep rolling out of Pressed Steel Tank Company's factory. Today, all of Hackney's facilities are pledged to the making of products for Victory. Hackney cylinders, drums and barrels are now in service for hundreds of war plants—helping to solve transportation and storage problems for vital chemicals. Thus, they are hastening the day when their advantages can be available to all businesses.

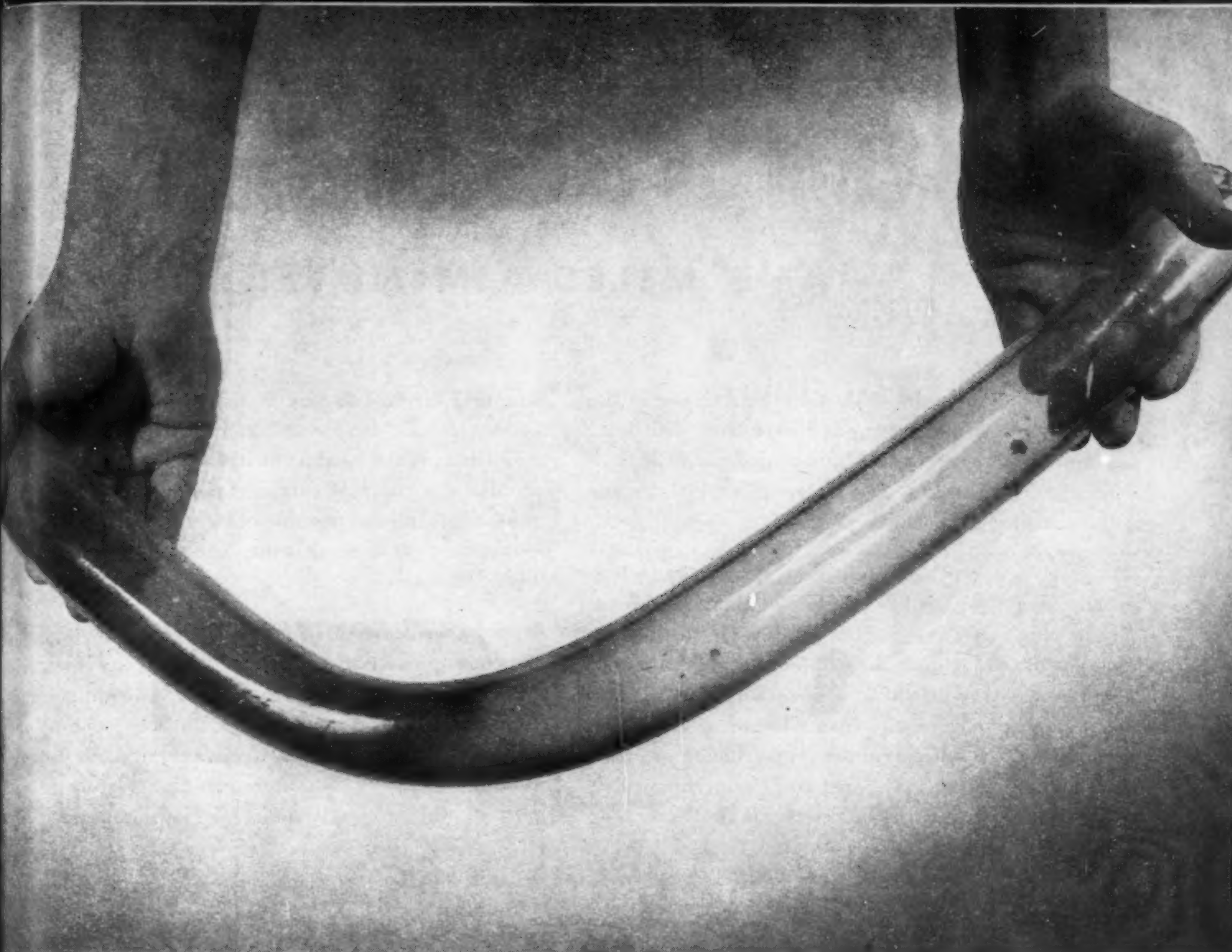
When that day arrives, the vast knowledge and research of Hackney's wartime experiences will be available to all industry. It is your assurance that Hackney will continue to make improved containers for gases, liquids and solids.

Pressed Steel Tank Company

GENERAL OFFICES AND FACTORY • 1447 SOUTH 66th STREET

Milwaukee, Wisconsin

CONTAINERS FOR GASES, LIQUIDS AND SOLIDS



PYREX PIPING *IS TOUGH!*

Part of a well-known wine cellar was razed by fire recently. Almost everything in the burned buildings was destroyed beyond salvage or recognition. But shown above is a section of PYREX brand glass piping picked out of the ruins. It was bent by the heat. One end was chipped when it crashed. It is of no earthly use today, yet it is still clearly a piece of Pyrex piping! By contrast, the tiny flecks visible on its surface are splashes of molten aluminum.

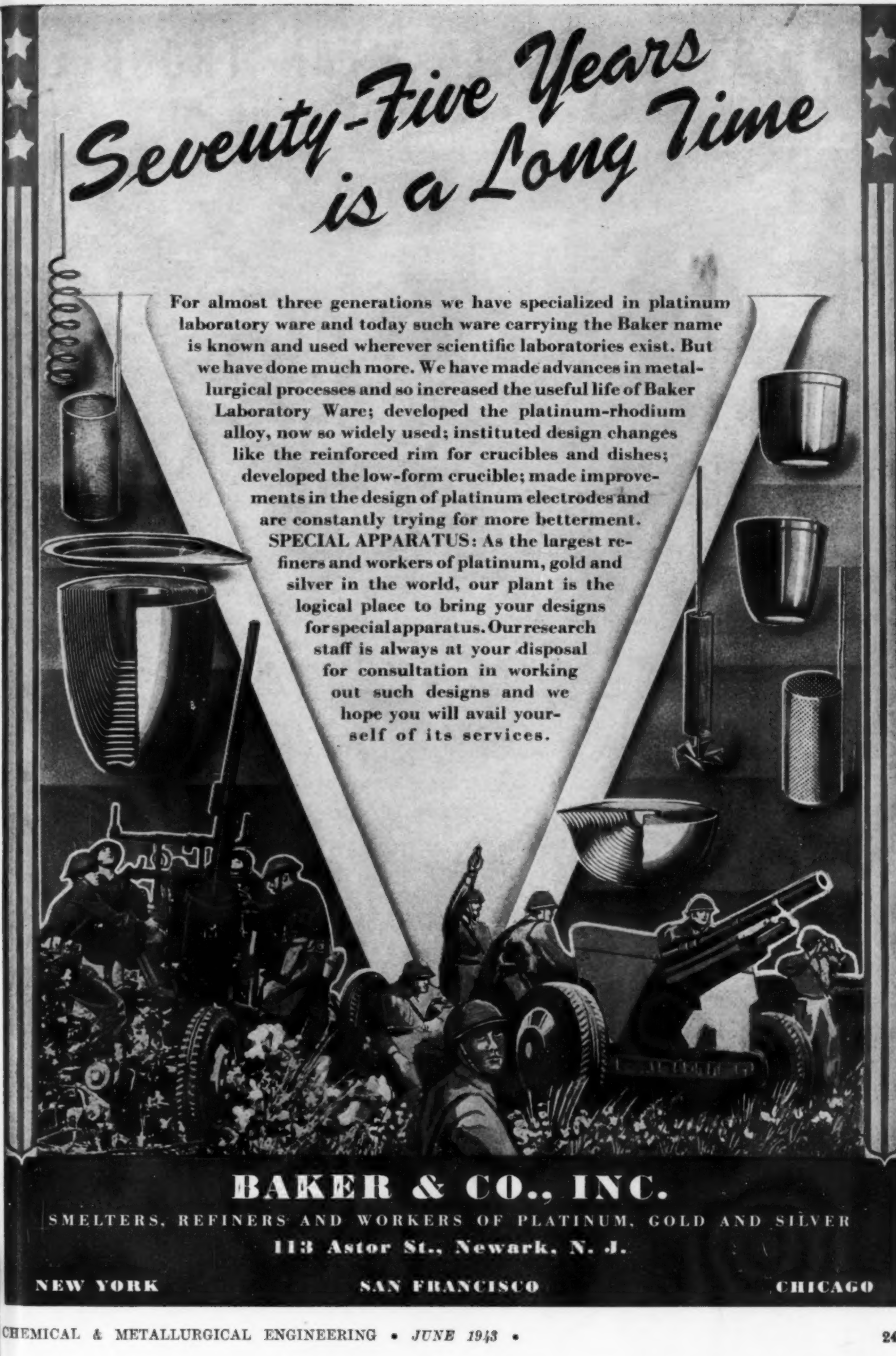
Engineers everywhere know that PYREX piping is chemically stable and highly resistant to thermal shock. They know that it is easy to clean and that its transparency facilitates and even assures the success of many operations. The one objection to its use—and it is raised *only* by those who have had no experience with it—is that glass is fragile. Engineers, however, with large installations of PYREX piping say that even under rough and ready conditions breakage is not a serious problem.

The above survivor of a devastating fire shows that PYREX piping can "take it"—that PYREX brand Industrial Glass has strength and stability far in excess of the demands of most industrial services. If you could benefit by the characteristics obtainable only in PYREX piping, write to the Industrial Division, Corning Glass Works, Corning, N. Y. And remember, PYREX Piping is available *today*.

"PYREX" is a registered trade-mark and indicates manufacture by Corning Glass Works, Corning, N. Y.

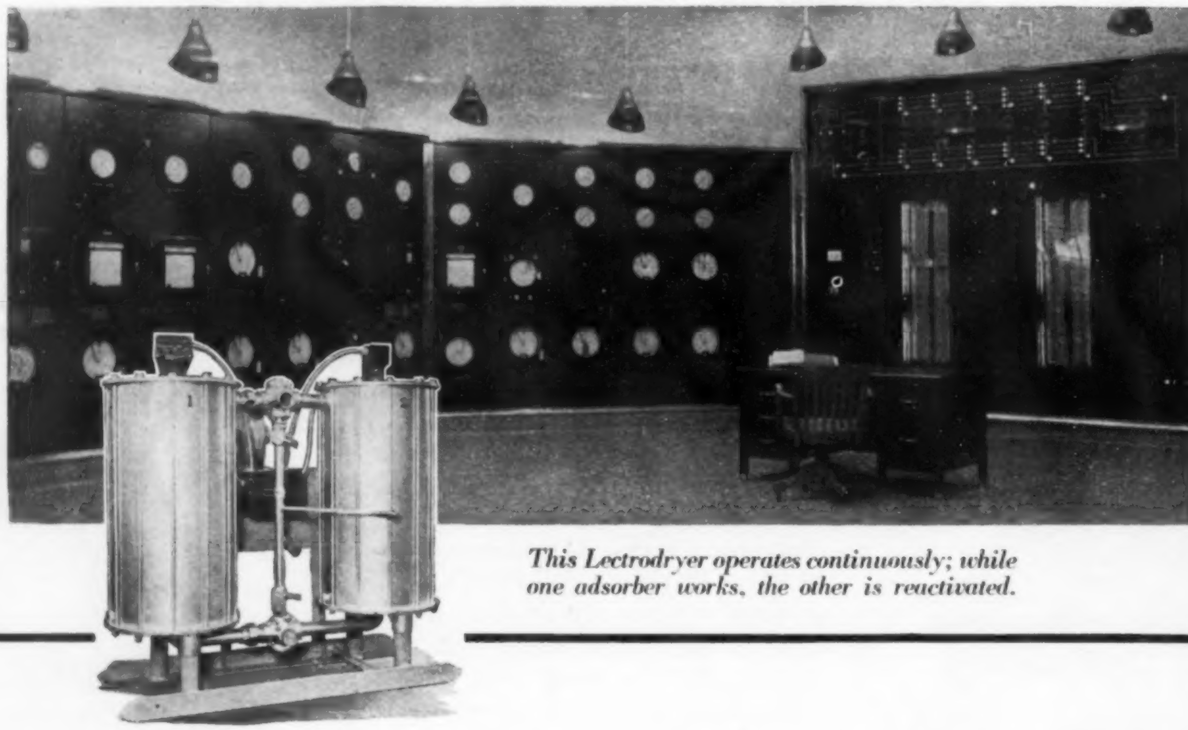
CORNING
Glass Works
Corning, New York

Pyrex Industrial Glass


Seventy-Five Years is a Long Time
For almost three generations we have specialized in platinum laboratory ware and today such ware carrying the Baker name is known and used wherever scientific laboratories exist. But we have done much more. We have made advances in metallurgical processes and so increased the useful life of Baker Laboratory Ware; developed the platinum-rhodium alloy, now so widely used; instituted design changes like the reinforced rim for crucibles and dishes; developed the low-form crucible; made improvements in the design of platinum electrodes and are constantly trying for more betterment.
SPECIAL APPARATUS: As the largest refiners and workers of platinum, gold and silver in the world, our plant is the logical place to bring your designs for special apparatus. Our research staff is always at your disposal for consultation in working out such designs and we hope you will avail yourself of its services.
BAKER & CO., INC.
SMELTERS, REFINERS AND WORKERS OF PLATINUM, GOLD AND SILVER
113 Astor St., Newark, N. J.
NEW YORK
SAN FRANCISCO
CHICAGO

MOISTURE WOULD MEAN TROUBLE,

so Lectrodryers DRY the Air



This Lectrodryer operates continuously; while one adsorber works, the other is reactivated.

This is the nerve center of a Houdry plant. From here, distant valves are automatically opened and closed, pumps are started and stopped, operations speeded up or slowed down. Pneumatic controls do the trick, providing even and exact modulation.

Moisture in the air lines would be a serious hazard here to continuous operation; even tiny drops of water would cause corrosion or freeze the valves, and tie the system in knots. So they made certain this problem was licked before the plant started up, and they keep constantly on guard against it.

LECTRODRYERS have that responsibility. They take the moisture out of the control lines, and they keep it out. Charged with Alorco Activated Alumina, they DRY the air to dew points below −110° F.

This is typical of the dependence placed on Lectrodryers in hundreds of plants all over the country; drying and conditioning air to standardize industrial processes; drying organic liquids. Perhaps Lectrodryer can help you. Write PITTSBURGH LECTRODRYER CORPORATION, 303 32nd Street, Pittsburgh, Pennsylvania.

LECTRODRYERS DRY WITH ACTIVATED ALUMINAS

PITTSBURGH
LECTRODRYER
Reg. U.S. Pat. Off.
CORPORATION

At night on a lonely beach

Landing boats and tank lighters are grounding on the beach and our army is establishing a beach head. This scene has been enacted at Guadalcanal — in North Africa and at little-known harbors in New Guinea.

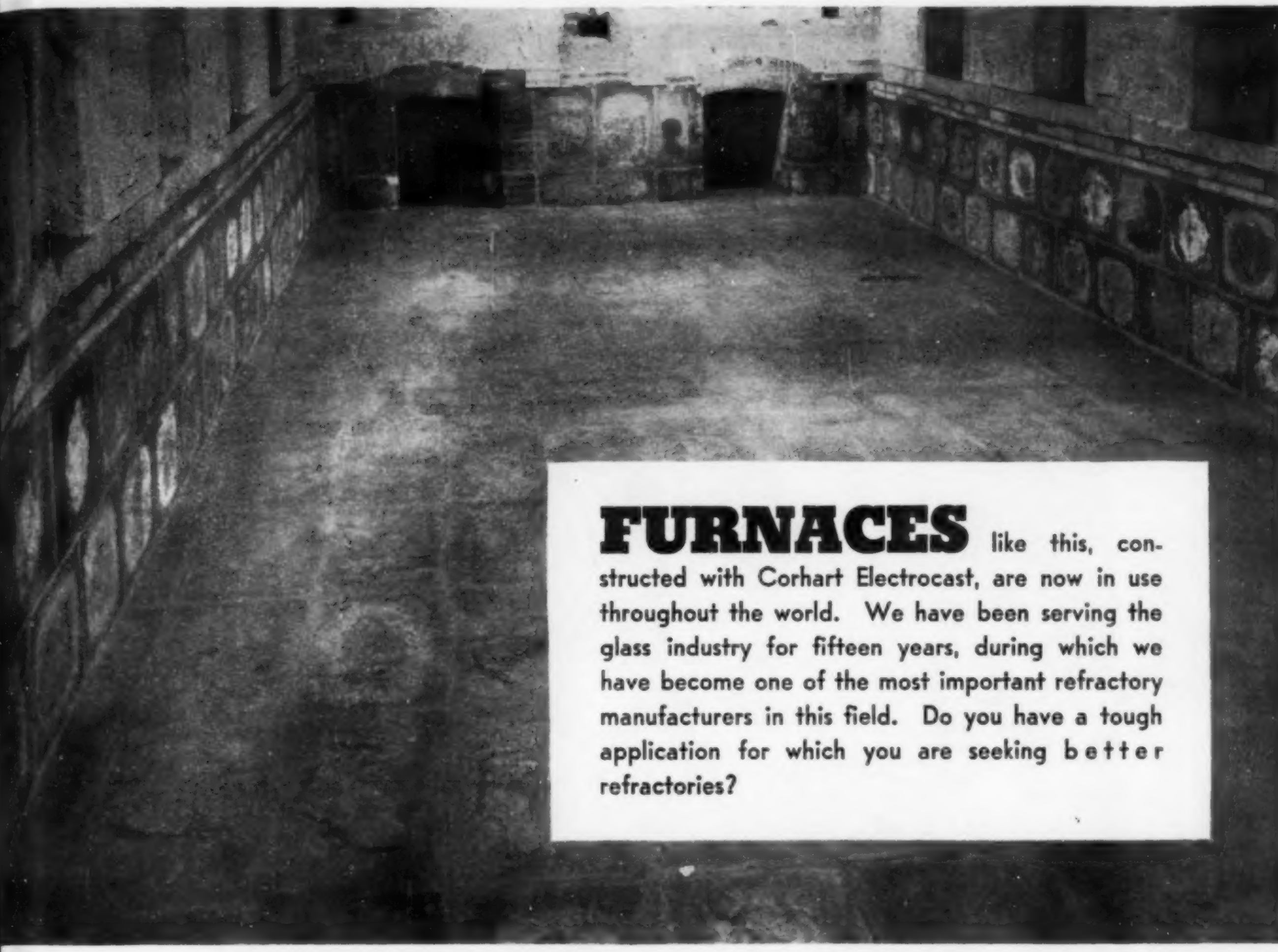
Dim shadows—low on the horizon—waves foaming on a sandy beach—then pushing through the darkness, landing barges bring threat of invasion to Axis-ruled lands!

Built to battle pounding surf—made to stand the jarring impact of landing—tough is the word for these barges. And tough is the word for the giant gears that drop their anchors and raise them. In fact, so tough are the blanks for these gears that cutting them was deemed an impossibility. Foote Bros. engineers and Foote Bros. workmen changed the conception of what was possible. And today, the landing barges which are keeping Hitler's armies pinned to the coast from Narvik to Tripoli give evidence of how well these special problems were solved.

Here at Foote Bros. new techniques and new manufacturing know-hows are responsible for gears and speed reducers of radically different design and construction—gears light in weight and of extreme precision for aircraft engines—gears of giant size and super toughness designed to stand the grueling punishment that only war can give.

But when the war is won and these same techniques can be applied to peacetime use, American manufacturers may look forward to revolutionary developments in all phases of power transmission.

FOOTE BROS. GEAR AND MACHINE CORPORATION
5225 South Western Boulevard • Chicago, Illinois



The entire flux-walls and bottom of this 16′ x 56′ glass furnace are constructed of Corhart Electrocast blocks.

Now Still <u>Another</u> Corhart* Uninsulated Bottom!

HERE'S another item to add to your "mental file" on Corhart* Electrocast bottoms.

In March, 1942, a well-known glass manufacturer installed his first uninsulated Corhart Electrocast melting-end bottom. On the strength of its performance, this customer has now installed another uninsulated Corhart bottom in another of his tanks. Both are of 12″ Corhart Standard Electrocast.

But these two tanks are by no means the only ones in which uninsulated Corhart bottoms are now being used.

In addition to numerous insulated bottoms, there are now at least THIRTY-EIGHT uninsulated Corhart bottom installations in glass tanks in North and South America. . . .

We knew you'd like to have these facts.

Corhart Refractories Company, Incorporated, Sixteenth & Lee Streets, Louisville, Kentucky.

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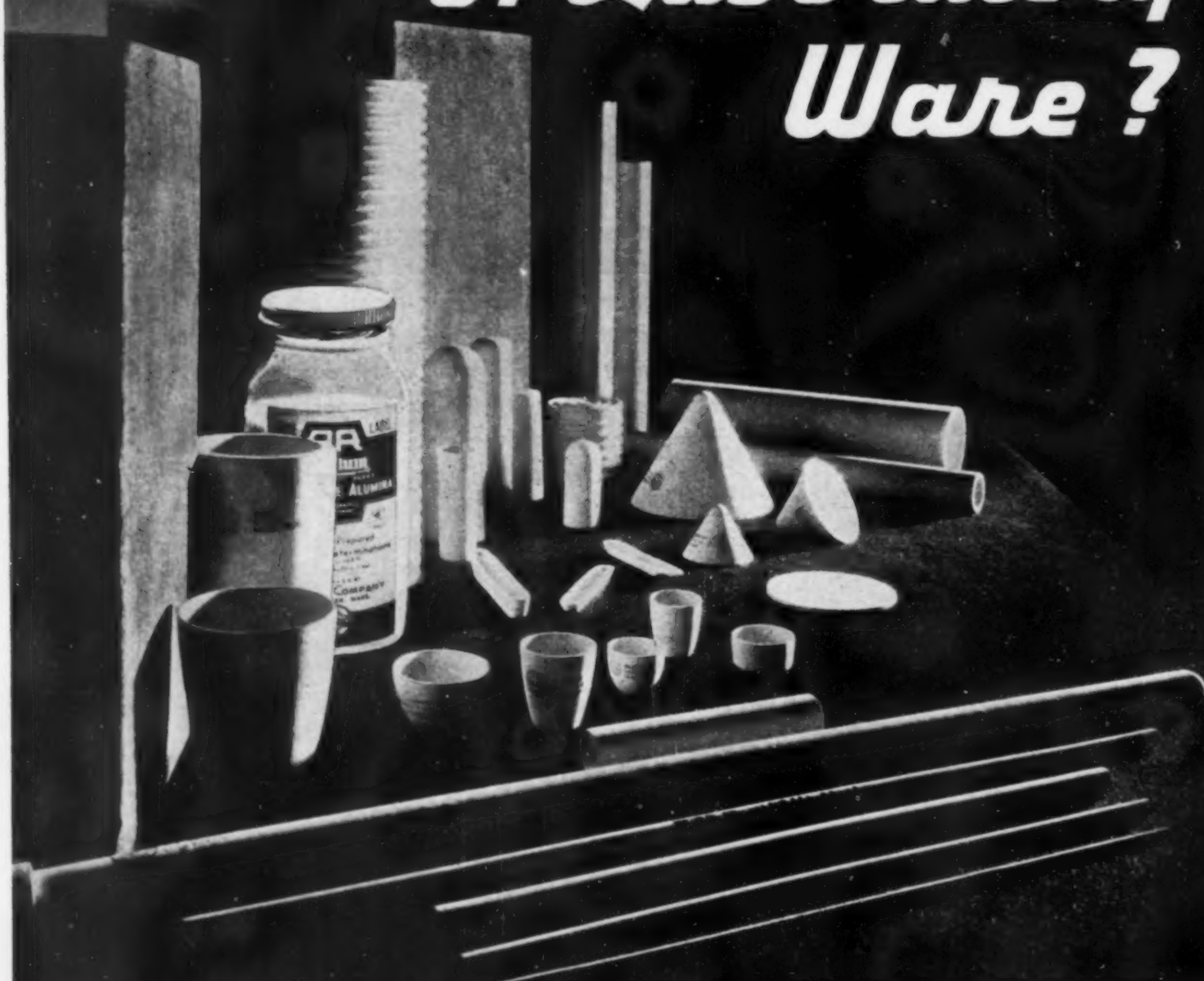
*Not a product, but a registered trade-mark.

QUALITY ECONOMY ENDURANCE

CORHART ELECTROCAST REFRACTORIES

How is Your Stock of Laboratory Ware?



Alundum Laboratory Ware is strong, will transfer heat readily, gives long service. Cleaning is a simple process of washing and igniting to constant weight. There are tubes, cores and muffles for electric furnaces; crucibles and dishes for igniting, incinerating and melting; dishes, cones, discs, thimbles and crucibles for filtering; combustion boats, pyrometer tubes, refractory cements. These can be obtained from your nearest laboratory supply house. *Send for catalog #793.*

NORTON COMPANY • WORCESTER, MASS.

NORTON ELECTRIC FURNACE FUSED **REFRACTORIES**

Nash Pumps of "PYREX" BRAND GLASS

Deliver Your Product with Purity Unchanged

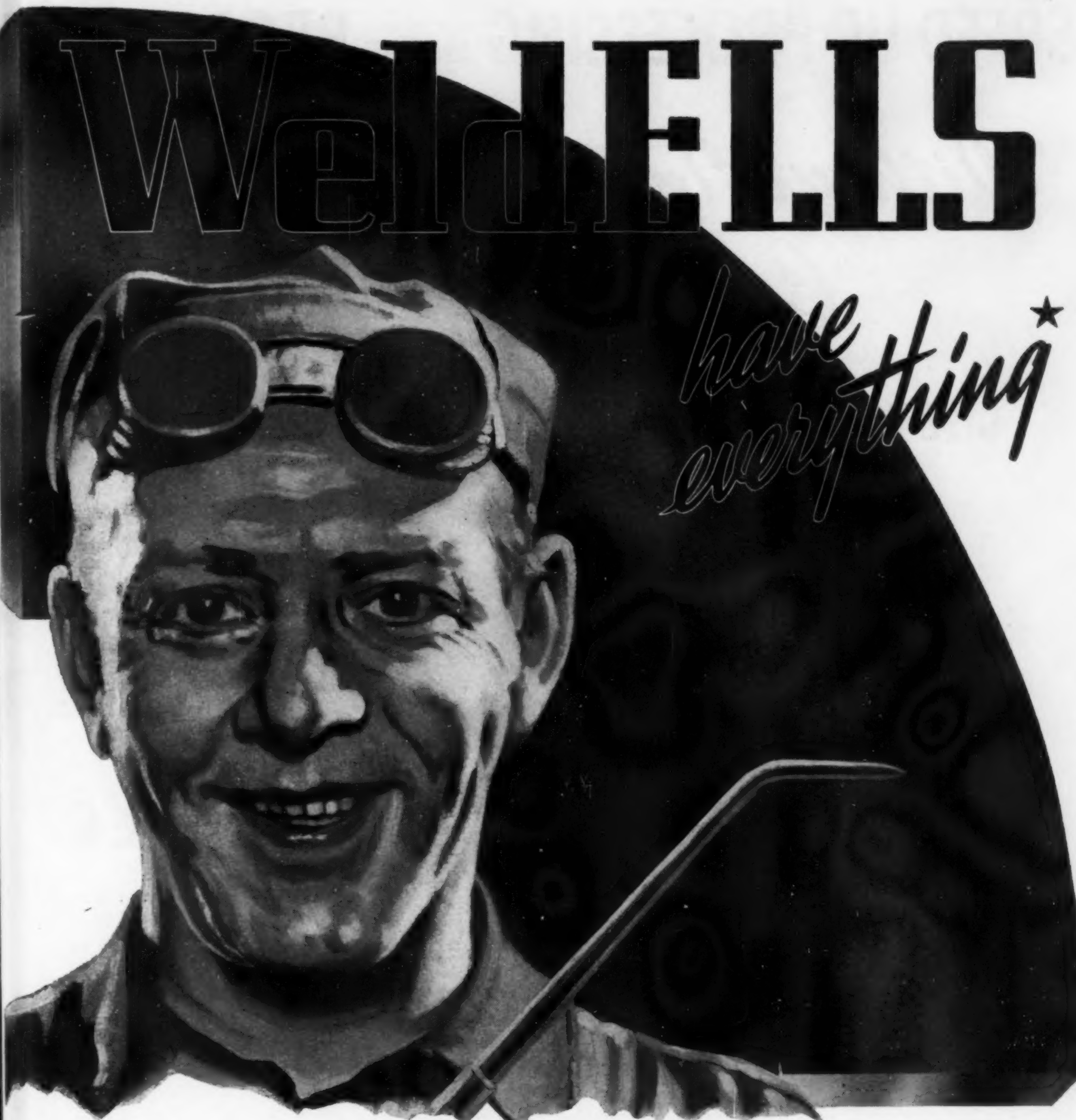
The Chemical Industries will find the new Nash Pumps of Glass particularly adaptable to the exacting liquid handling requirements of this field. Constructed of heat and shock resisting "PYREX" brand glass, they present a means of transferring not only corrosive acids, but any liquid chemical product which must be kept free from contamination.

All working parts of these centrifugals, including impeller and casing, are constructed of sparkling glass, with complete transparency, permitting constant inspection of product for color and condition. If pump needs cleaning it is immediately made visible, and the pump may be readily opened, cleaned, and reassembled. A unique mechanical seal replaces the conventional stuffing box, and a safety unloading device eliminates possibility of fracture of the glass casing should pump accidentally be subjected to excessive pressure. Hot acids and brine cooled liquids are handled with equal facility.

Nash Pumps of Glass are at present available in two sizes, a 6000 gallon per hour unit for large installations, and a unit with a capacity of 10 gallons per minute for small installations, and laboratory and pilot plant operation. Bulletins describing these sensational pumps in detail will be sent immediately upon request.

NASH ENGINEERING COMPANY

23 S. WILSON ROAD • SOUTH NORWALK, CONNECTICUT



"You said it, brother—EVERYTHING!"

His job is *welding;* not fooling around getting ready to weld.

He can put more time on actual welding when he uses WeldELLS:*

—Because their tangents make them easier to line up.

—Because their precision quarter-marked ends simplify layout.

—Because the size and thickness are permanently marked on every fitting.

He can turn out a better job, too, when he uses WeldELLS—thanks to their dimensional accuracy and to the machine tool beveled ends that provide an ideal welding surface.

And the features that mean so much to the welder are also vitally important to the men who engineer the job and those who live with it.

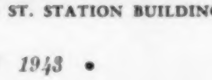
★ No other fittings for pipe welding combine these features found in WeldELLS:

- **Seamless** — greater strength and uniformity.
- **Tangents** — keep weld away from zone of highest stress — simplify lining up.
- **Precision quarter-marked ends** — simplify layout and help insure accuracy.
- **Selective reinforcement** — provides uniform strength.
- **Permanent and complete identification marking** — saves time and eliminates errors in shop and field.
- **Wall thickness never less than specification minimum** — assures full strength and long life.
- **Machine tool beveled ends** — provides best welding surface and accurate bevel and land.
- **The most complete line of Welding Fittings and Forged Steel Flanges in the World** — insures complete service and undivided responsibility.

* WeldELLS and many other Taylor Forge products are produced in Byers Genuine Wrought Iron.

TAYLOR FORGE & PIPE WORKS, General Offices & Works: Chicago, P. O. Box 485

* The list of Taylor Forge's contributions to the war effort only begins with WeldELLS. One of many examples is Taylor Corrugated Marine Furnaces, essential to many merchant ships and transports.



NEW YORK OFFICE: 50 CHURCH ST. • PHILADELPHIA OFFICE: BROAD ST. STATION BUILDING


MAXIMUM EFFICIENCY WITH MINIMUM COST
INTERNATIONAL
MIXING & PROCESSING EQUIPMENT
INTERNATIONAL
AUTOCLAVES, PROCESS MIXERS, KETTLES, DIGESTERS
PERMANENT MIXERS
Direct Drive or Gear Drive, in all capacities.
BLENDERS
PEBBLE AND BALL MILLS
SIDE ENTRANCE MIXERS
1/3 to 25 H. P. sizes
CATALOG
on Mixers, Agitators, Blenders, etc., No. 101 now ready.
CATALOG No. 85 on BALL MILLS — Either catalog or both sent on request.
MIXERS
Complete with Tank and Drive Unit—in various types and sizes, with any style stirrers, propellers or turbine.
INTERNATIONAL ENGINEERING, INC., DAYTON, OHIO
NEW YORK—15 Park Row
CHICAGO—407 S. Dearborn St.

EHRET'S 85% MAGNESIA and many other Ehret heat insulating materials are fully treated, both as to selection and application, in the new 176-page Heat Insulation Handbook. It will be furnished, without obligation, to those interested in getting the most from their thermal insulations. Write today for your copy.

...and for INSULATION *85% Magnesia*

For countless years, saddles have been made of leather... and for good reason. It is the *one* material that has proved to be most suitable for this use.

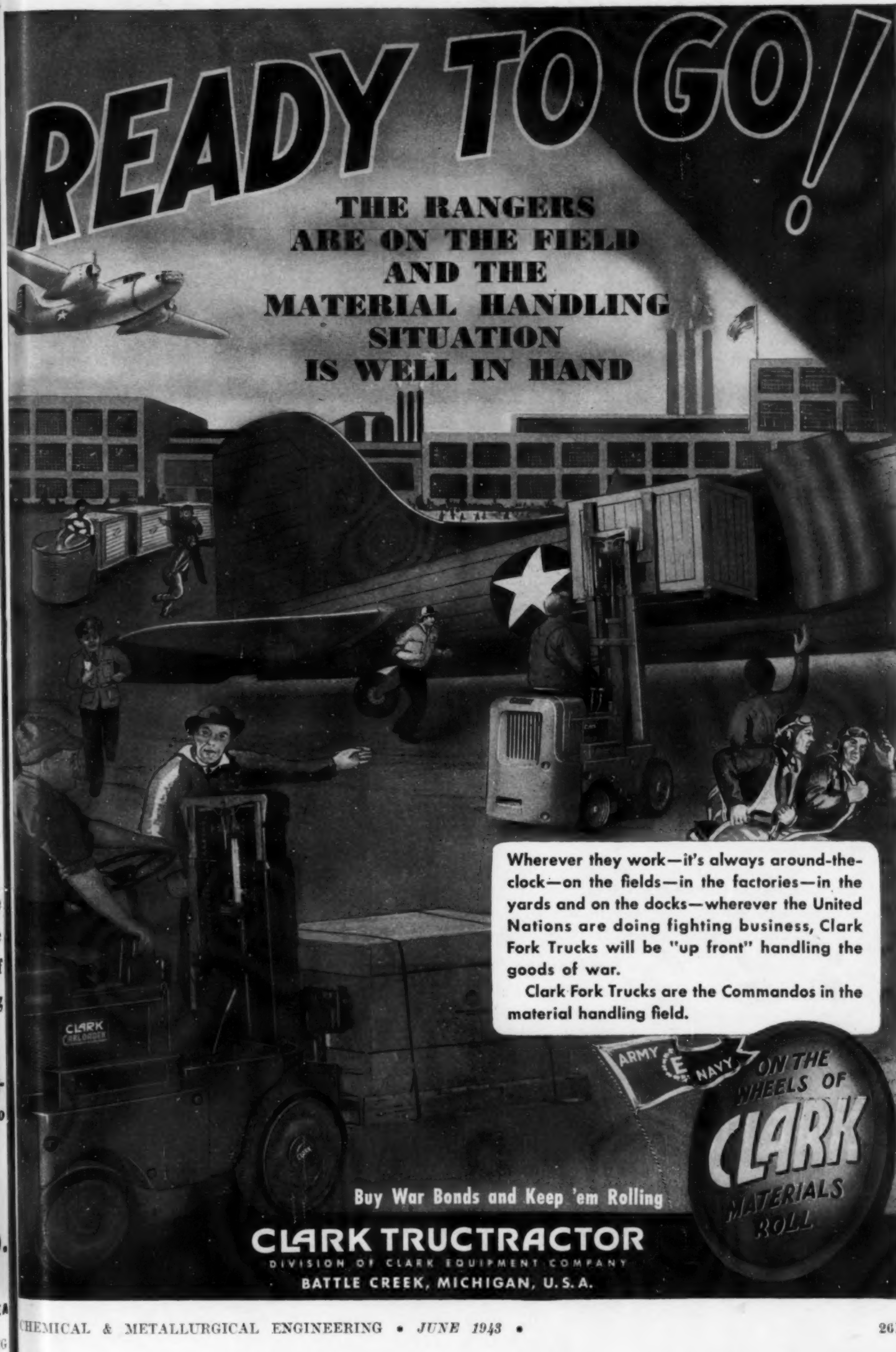
★ ★ ★

And in the field of pipe and boiler insulations, there is *one* material that has withstood the test of time ...85% Magnesia. Service records of more than half a century provide uncontestable proof of enduring thermal efficiency and overall economy.

When you buy insulations you are making a long-term investment. It will pay you to continue to specify Ehret's 85% Magnesia.

EHRET MAGNESIA *Ehret* MANUFACTURING CO.
VALLEY FORGE, PENNA.

...THERE IS AN *EHRET* DISTRIBUTOR OR CONTRACTOR IN EVERY INDUSTRIAL AREA


READY TO GO!
THE RANGERS ARE ON THE FIELD AND THE MATERIAL HANDLING SITUATION IS WELL IN HAND
Wherever they work—it's always around-the-clock—on the fields—in the factories—in the yards and on the docks—wherever the United Nations are doing fighting business, Clark Fork Trucks will be "up front" handling the goods of war.
Clark Fork Trucks are the Commandos in the material handling field.
ARMY E NAVY
ON THE WHEELS OF CLARK MATERIALS ROLL
CLARK
Buy War Bonds and Keep 'em Rolling
CLARK TRUCTRACTOR
DIVISION OF CLARK EQUIPMENT COMPANY
BATTLE CREEK, MICHIGAN, U.S.A.

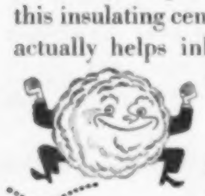
FACTS YOU MAY NOT KNOW ABOUT EAGLE MINERAL WOOL INSULATION

EAGLE SUPER "66" INSULATION INHIBITS RUST

—razor blade test shows!

Bury a shiny new razor blade in a wet ball of Super "66"—Eagle-Picher's outstanding Insulation for temperatures up to 1800° F. Let ball and blade stand several weeks. When removed, notice how free from rust the blade is.

No trick of parlor magic . . . but proof positive that this insulating cement is not merely non-corrosive, but actually helps inhibit rust! And its insulating efficiency is remarkably outstanding.



Springy Ball Structure

Secret of the sensational insulating efficiency of Eagle Super "66" lies in the springy pellets of Eagle Mineral Wool that are its basic ingredient. *After* the insulation is applied, this springy structure is still retained. Pellets contain millions of dead air cells which do not crush down. Full efficiency is maintained—coverage is increased, and shrinkage held to a minimum.

All Purpose—and it's Reclaimable

Eagle Super "66" can be applied to practically all heating equipment. It requires no special tools; exceptional workability means low installation cost. And when used on temperatures up to 1200° F., it may be removed, reworked and reused if desired!

We will send on request full particulars on Eagle-Picher High Temperature Insulations, and show how they will save you money and fuel. Current demand is very heavy, but we are endeavoring to fill all orders without undue delay.

EAGLE-PICHER HIGH TEMPERATURE INSULATIONS

Eagle Super "66" Plastic Insulation
Eagle Supertemp Blocks
Eagle L-T Felts
Eagle Blankets

EAGLE EP PICHER 1843 1943

Eagle Finishing Cements
Eagle Loose Wool
Eagle Insulseal
Eagle Insul-stic

THE EAGLE-PICHER LEAD COMPANY, Cincinnati, Ohio

TO MAKE YOUR "CHANGE-OVER" A CHANGE FOR THE BETTER

Reconversion — America's post-war challenge to Industry — *can* be an unparalleled opportunity to improve your process and product, with the help of AT&M centrifugals.

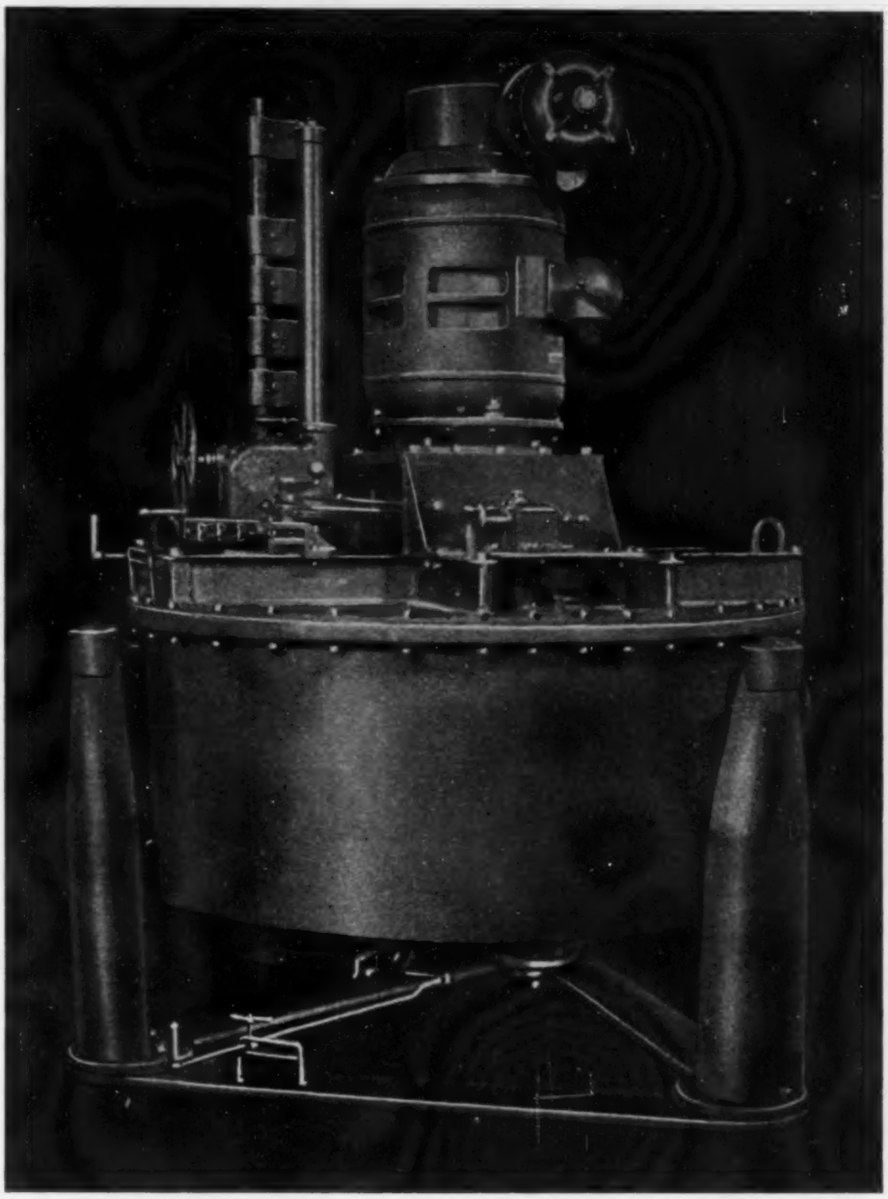
"Change-over" from filters. In some instances, filters have been found hard-to-clean and wasteful of fine substances. A change-over to AT&M centrifugals has saved production time, loss of materials and floor space . . . in one case saving 25 to 40 percent of a scarce chemical.

"Change-over" from tanks, kiers, or autoclaves. In impregnation, also, AT&M-engineered centrifugal force now presses liquids into semi-solids or solids, faster, more uniformly, more conveniently — then throws off the surplus in the same swift, space-saving operation. Today, nitrating and final wringing of cotton for war explosives is speeded up by AT&M centrifugals.

"Change-over" from settling tanks. In precipitation of particle-sized substances, or slimes from suspension, advantages of change to AT&M centrifugals have included immediate precipitation, finer degree of clarity, dryer cake. Floor space saved, of course.

"Change-over" from ovens, squeeze rolls, boxes. In dehydration, A T & M centrifugals whirl out H_2O in a hurry — in one case 70% faster than an expensive machine formerly used for drying. Savings over other equipment also include cost of power, time of supervision, factory footage.

After the war, A T & M centrifugals, now heavily engaged in war production, will be available in all machinable metals and coatings . . . link-suspended . . . suspended . . . base-bearing . . . with additional time-and-space-saving advances stimulated by war.



Now is the time, as national needs permit, to plan with us how you can get the most out of your re-conversion dollars, or solve the special problems which AT&M engineers are accustomed to deal with . . . in strict confidence. Write American Tool & Machine Co., 1415 Hyde Park Avenue, Boston, — or 30A Church Street, New York, N. Y.

AT&M Centrifugals Save Time and Space in—

EXTRACTION
DEHYDRATION
FILTRATION
PRECIPITATION
IMPREGNATION
COATING

A T and M

A T & M CENTRIFUGALS SAVE TIME AND SPACE

RIGID INSPECTION AND TESTING — *Insure High Quality*

Opposed impeller centrifugal pump on test

Axial section of the pump

The highest quality of engineering design and of workmanship has always been the ideal of the De Laval Steam Turbine Company. High grade machines can be produced only by care in selecting and purchasing materials and by the use of specialized equipment, including precision tools, gages, jigs and measuring devices, followed by limit-gage inspection of finished surfaces and by thorough testing of completed units.

The testing here shown of a two-stage De Laval Pump is typical of the routine testing of De Laval centrifugal pumps. The pump is driven by a calibrated motor and accurate readings are made of speed, pressure, delivery and power consumption over the working range. The unit is then dismantled and all working surfaces are again inspected and checked. In some cases a torsion meter is used for determining input.

A similar procedure is followed with De Laval steam turbines, helical and worm gears, centrifugal compressors, and rotary displacement oil pumps.

The testing equipment includes suitable gages and meters for measuring power and fluids of all kinds and at various pressures and temperatures, also plant for generating steam at high pressure and temperature and for producing high vacuum.

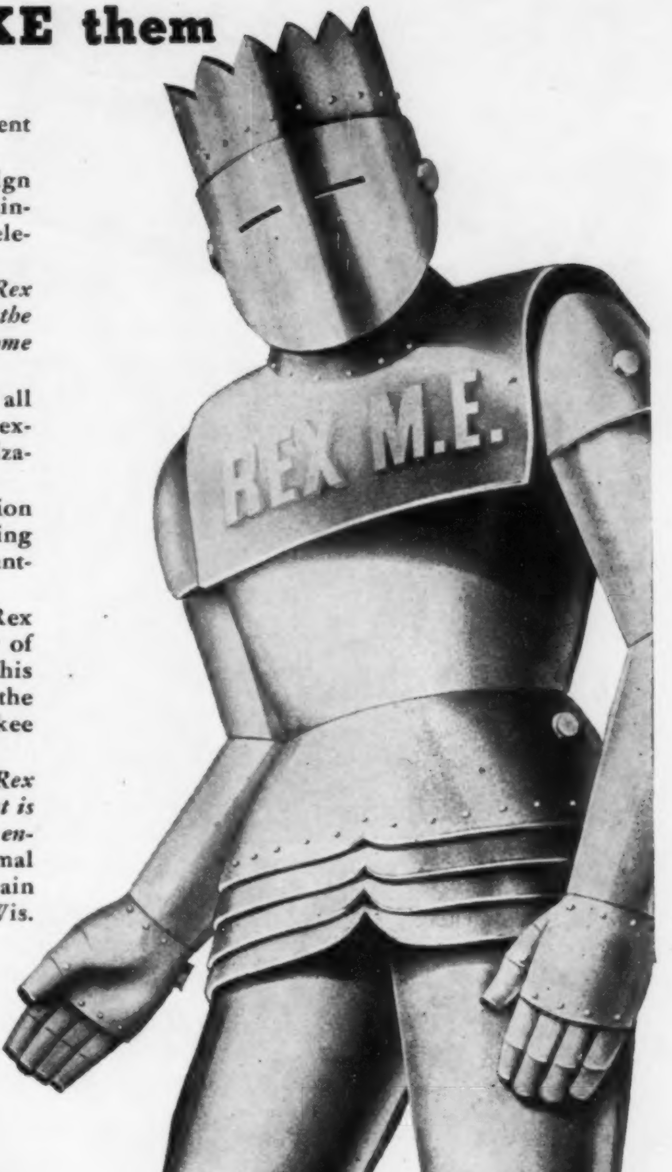
M-34

DE LAVAL *Steam Turbine Co.*

TRENTON, N.J.

MANUFACTURERS OF TURBINES . . . STEAM, HYDRAULIC; PUMPS . . . CENTRIFUGAL, CLOGLESS, ROTARY DISPLACEMENT, MOTOR-MOUNTED, MIXED-FLOW, PROPELLER; PRIMING SYSTEMS; CENTRIFUGAL BLOWERS and COMPRESSORS; GEARS . . . WORM, HELICAL, and FLEXIBLE COUPLINGS

He does more than MAKE them



MANUFACTURING materials handling equipment is only part of his work.

His business is mechanical engineering: the design . . . manufacture . . . application . . . selling and maintenance of units, assemblies and installations for elevating and conveying.

In order to design and manufacture his products, Rex Mechanical Engineering—Rex M. E.—must perform the functions of application and selling. These are in some ways his most important duties.

Because of the complexity of modern industry, all engineers must seek and get from each other the extensive and intensive knowledge that only specialization can provide.

Application and selling are technical information services provided by specialists to help in analyzing problems and in finding the best ways for surmounting them.

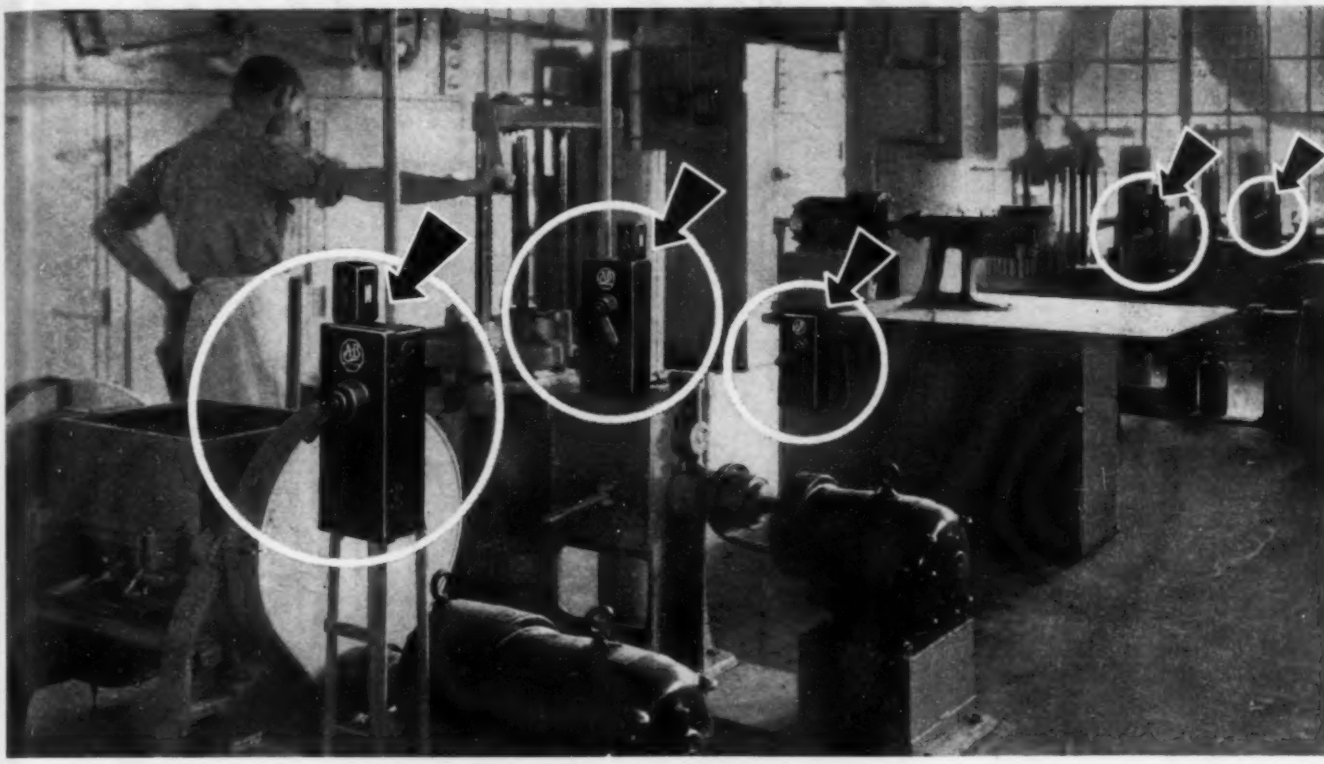
For this service Rex Mechanical Engineering—Rex M. E.—maintains a territorial organization. Many of the men in it have served their apprenticeship in his drafting rooms and plants. For additional counsel, the field men call on his designing engineers in Milwaukee who have the advantages of national experience.

Through the work of all these men in many fields, Rex M. E. is learning—and making available—much that is helpful in the great work in which all engineers are engaged, namely, to achieve a maximal result at minimal cost and waste. For complete information, write Chain Belt Company, 1648 West Bruce St., Milwaukee, Wis.

REX Materials Handling Equipment

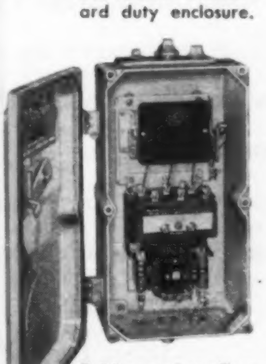
UNITS • ASSEMBLIES • INSTALLATIONS

CHAIN BELT COMPANY OF MILWAUKEE



This pharmaceutical plant saves critical wiring materials by using Combination Starters

Bulletin 712 combination starter in standard duty enclosure.



Rubber gasket effectively seals the water-tight enclosure.

Allen-Bradley combination starters save copper, steel, and labor by combining a manually operated disconnect unit and a solenoid operated motor starter all in one cabinet. With only one box to install, which is smaller than two boxes combined, less copper wire, steel conduit, lock nuts, bushings, and other fittings are required. They save installation time, too.

This pharmaceutical plant is also assured of a lifetime of trouble-free service from its motor controls. The starters have only one moving part, the plunger that opens and closes the double break contacts with a straight line vertical motion. All pins, pivots, hinges, bearings, and flexible jumpers are eliminated. There's nothing to break, wear, or stick. The patented double break, silver alloy contacts with which both starter and disconnect switch are equipped never need any cleaning, dressing, or filing.

You can save critical wiring materials in your plant and be sure of trouble-free service by specifying Allen-Bradley combination starters.

Allen-Bradley Company
1337 S. First St.
Milwaukee, Wis.

A-B Quality

An Enclosure for Every Application

General Purpose—This enclosure is of bonderized sheet steel. Black enamel exterior. White enamel interior. Both are infra-red "cured" for longer life. Knockouts on all sides. The general purpose starter is also made in a low-cost, semi-dust-tight construction for locations where dust conditions are light.

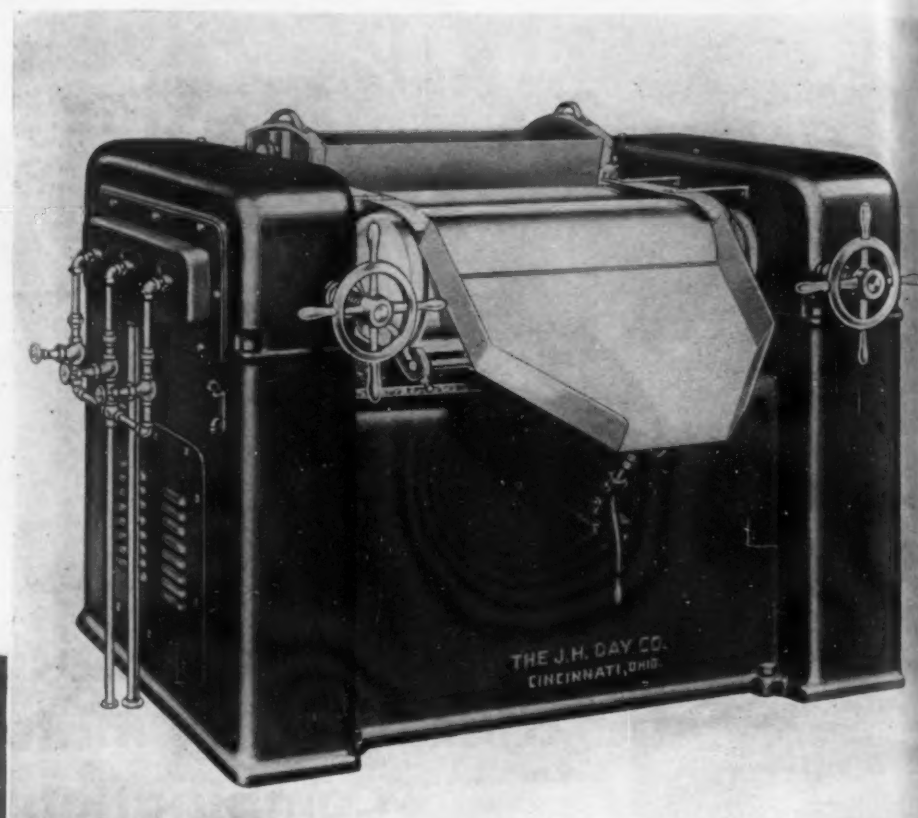
Water-Tight—Used wherever splashing water or moisture laden air is encountered. Enclosure is of cast iron, cadmium plated against corrosion. Live rubber gasket seal between cover and base excludes moisture. Threaded conduit openings provided at top and bottom.

Hazardous Atmosphere—Cast iron enclosure is effectively sealed by wide machined flanges on base and cover. Black enamel outside, white inside. Satisfies Underwriters' Laboratories' requirements for Class 2, Group G hazardous dust locations.

Flush Mounting—Both open and closed types for mounting in machine tool bases or in plastered walls. Neat and compact with generous wiring space. Easy to install. Flush plate is made of sheet steel and finished in machine tool gray.

ALLEN-BRADLEY
SOLENOID MOTOR CONTROL

ROLLS *that keep rolling* ON SKF BEARINGS



● *Built by*
THE J. H. DAY CO.

Production grinding of inks, paints, varnishes, etc., must be done on well-designed and well-built mills . . . with roll-neck bearings that carry heavy loads at high speeds and that locate the rolls with unvarying accuracy. SKF Spherical Roller Bearings do this—unaffected by misalignment or shaft deflection. The smooth performance of a mill cannot be smoother than the performance of its bearings. 5301

SKF INDUSTRIES, INC., PHILA., PA.

Scheduled to appear in the following publication, subject to change: Chemical & Metallurgical Engineering, 6-1-43

New ELECTRONIC POTENTIOMETER

Eliminates Manual Balancing

NO longer is it necessary to manually balance an Indicating Potentiometer to obtain temperature readings.

The new Brown Electronic "Self-balancing" Precision Indicator reads the correct temperature instantly when the operator throws the proper key switch.

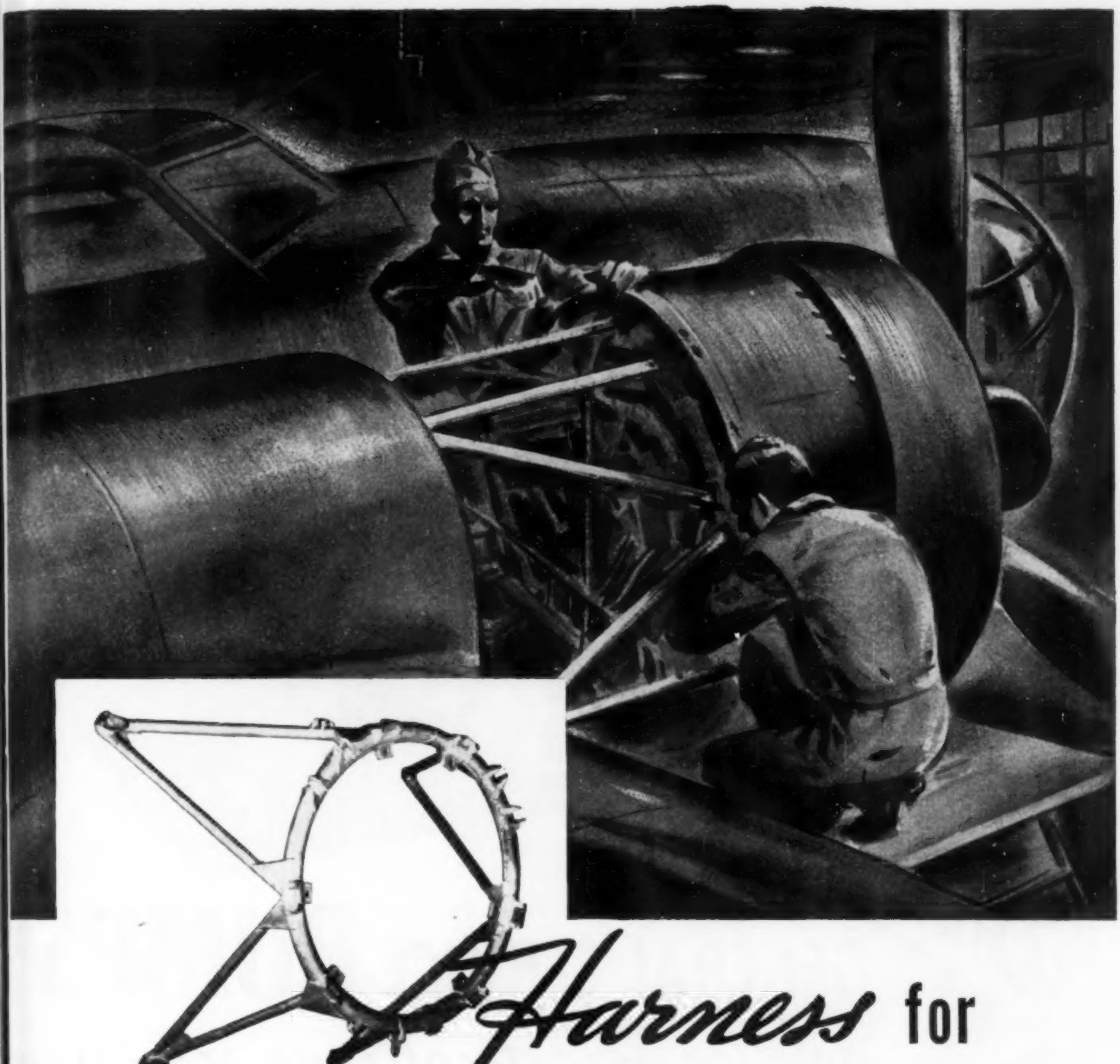
This new instrument utilizes the standard "Continuous Balance" electronic principle incorporated in the well-known Brown Circular Chart Air-O-Line Potentiometer Controller. It uses no conventional galvanometer and is not affected by vibration.

Precision readings are made possible by the use of a rotating scale, over 28" in length, graduated to permit readings to within one part in 2400. This scale is power driven and can travel through full range in less than 10 seconds. There is no waiting for a galvanometer to balance—the instrument balances quickly without cycling.

The Brown Precision Indicator can be used with any number of separately mounted key switches, in exactly the same manner now employed in manually balanced instruments. Integrally mounted push button switches will also be available in limited quantities.

WRITE THE BROWN INSTRUMENT COMPANY, 4478 Wayne Avenue, Philadelphia, Pennsylvania, a division of Minneapolis-Honeywell Regulator Company, Minneapolis, Minnesota. Offices in all principal cities. 119 Peter Street, Toronto, Canada—Wadsworth Road, Perivale, Middlesex, England—Nybrokajen 7, Stockholm, Sweden.

Instruments by **BROWN** *and Controls by* **MINNEAPOLIS-HONEYWELL**



Harness for 2000 HORSEPOWER—PLUS!

Supporting an engine at rest and harnessing its surging power in flight, the engine mount must possess a liberal margin of strength. Yet it must be light—must add the fewest possible pounds to the weight of the plane. Seamless steel tubing answers these exacting requirements.

Formed and welded into sturdy engine mounts, seamless steel tubes harness power plants and planes into superb fighting units.

MICHIGAN SEAMLESS TUBE COMPANY

SOUTH LYON, MICHIGAN

LABORATORY SERVICE FOR TUBING USERS

Manufacturers faced with production problems or future plans involving the use of steel tubing are invited to contact Michigan Seamless Tube Company. Development work for users of tubing is a major activity of our complete metallurgical and chemical laboratory. There is no obligation, of course.


"Install 'em and Forget 'em!"
BUFFALO PUMPS INC.

When Johnny, Mike, Pete and Mary

come marching home!

THAT will be the Great Day when the victorious boys—and the girls—come back to the wide open arms of America.

A Great Day that isn't so far away.

They probably haven't realized it but Industry has found the time somehow, apart from its tremendous war effort, to plan and develop new things that will enhance and improve our future living.

New developments in metals and alloys, fuels, plastics, chemicals, rubber, foods, synthetics, textiles—and electronics which will be reflected in the coming higher standards of peace-time living.

Right now in thousands of laboratories—in pilot plants—on the drawing boards—in the conference rooms—Industry is experimenting, planning, discussing.

And in many of these almost revolutionary processes that are already under way or are being planned, super refractories by Carborundum are considered as vitally important factors.

If you, too, are working on or considering a new process involving the use of refractories, there is undoubtedly one or more Carborundum Brand Super Refractories that will improve the efficiency of your operation.

It may be that your conditions call for a refractory having high refractoriness or high heat conductivity.

Perhaps resistance to spalling or softening or great strength at elevated temperatures is most important.

Whatever the essential quality, characteristic or application may be, we are confident that super refractories by Carborundum and our research and engineering will prove invaluable.

We would welcome the opportunity of consulting with you.

REFRACTORY
CARBORUNDUM
PRODUCTS

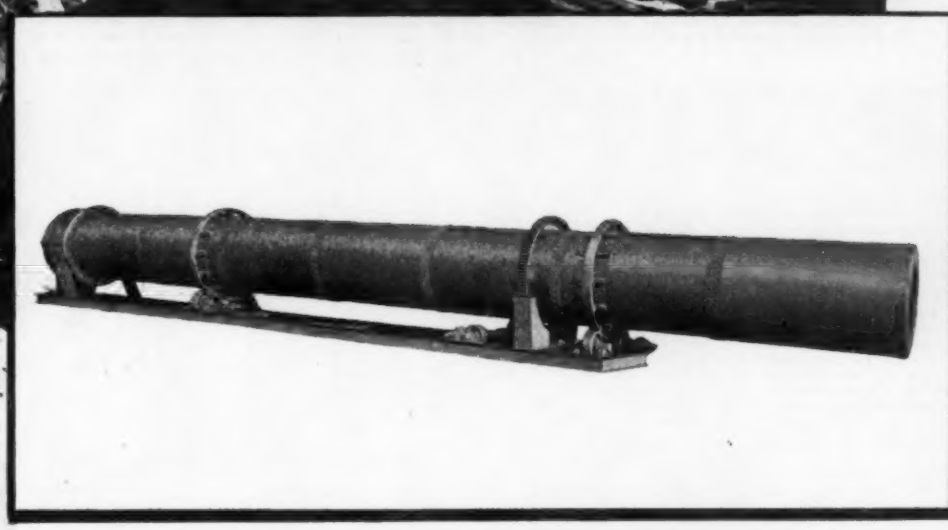
Refractory Division, **THE CARBORUNDUM COMPANY,** *Perth Amboy, N.J.*
REG. U. S. PAT. OFF.

MANUFACTURERS OF GRINDING WHEELS, COATED ABRASIVES, SUPER REFRACTORIES, HEATING ELEMENT

District Sales Branches: Chicago, Philadelphia, Detroit, Cleveland, Boston, Pittsburgh. Distributors: McConnell Sales and Engineering Corporation, Birmingham, Al Christy Firebrick Company, St. Louis, Mo.; Harrison & Company, Salt Lake City, Utah; Pacific Abrasive Supply Company, Los Angeles, San Francisco, Calif.; Den Fire Clay Company, El Paso, Texas; Smith-Sharpe Company, Minneapolis, Minn.

(Carborundum is a registered trade-mark of and indicates manufacture by The Carborundum Company)

TOUGH



THE ALCAN HIGHWAY

— an engineering epic, breathtaking in size and ruggedness, imaginative in concept, but a military necessity — therefore, the impossible was done and in record-breaking time.

In half a year, stretching 1800 gruelling miles, through the vast wilderness of British Columbia, over frothy streams and the rugged mountains of the Yukon Territory, through the ice-locked back door of Alaska, was blazed a highway linking civilization with our northern outposts.

Courageous men of purpose, with tough equipment, working most often in arctic storms and temperatures 35 degrees and more below zero, have again written history for a great continent!

FOR TOUGH ASSIGNMENTS

Like the mighty builders of the Alcan Highway, Standard Steel has won a reputation for tough jobs done with the precision, speed and quality demanded by war or peacetime conditions.

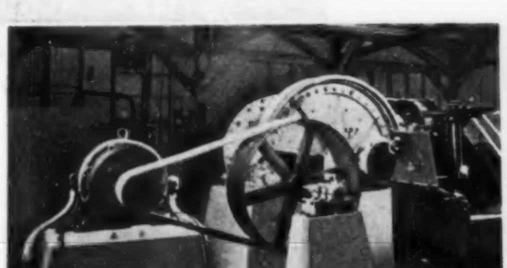
For more than 20 years, Standard Steel has served Industry in the design, fabrication and erection of equipment built from steel plate.

Illustrated above is a rotary dryer, typical of the equipment available to the process industries.

Sturdy, rugged construction, down to the last detail affords continuous, trouble-free performance.

Though devoted to the war effort "around the clock"—expanded plant capacity affords the opportunity to bid on additional difficult jobs. Perhaps a Standard Steel engineer can help with YOUR production problem!

Write today for Bulletin 200 and 601 giving details.



BALL MILLS—*Heavy steel end flanges; plate steel spiral feeder; marine design supporting bearing; wide range of sizes.*

STANDARD

STEEL CORPORATION

General Offices and Plant • 5001 South Boyle Avenue
Los Angeles, California

ENGINEERING DATA

SPECIFICATIONS—HARDINGE BALL MILL

Size Mill	Weight of		Weight of Balls		R.P.M. Mill		Horsepower				CAPACITY IN TONS PER 24 HOURS				
	Mill	Lining	Min.	Max.	Min.	Max.	To Run Min.	To Run Max.	Of Motor Min.	Of Motor Max.	1½" to 10 Mesh	¾" to 48 Mesh	½" to 100 Mesh	¼" to 98% −200 Mesh	¼" to 98% −325 Mesh
2'x8"	1150	......	500	650	35.2	46	1.5	2	1.5	2	7	3.5	2.5	1.5	1
3'x8"	2700	1400	1000	1300	30.4	39.8	5	6	5	7.5	21	10	8	5	3
4½'x16"	7000	5200	3600	4600	25.2	33	15	18	15	20	65	33	23	15	9
5'x22"	10200	8000	6500	8300	23.2	30.4	32	37	30	40	140	70	49	31	19
6'x22"	15300	10000	10500	13500	21.2	27.7	52	60	50	60	232	105	80	52	31
7'x36"	20000	15400	20000	26000	19.4	25.4	92	115	100	125	465	225	155	102	61
8'x48"	29000	23000	34000	43500	18.2	23.8	163	200	175	200	820	394	274	179	108
9'x48"	38000	28000	45000	58000	17.3	22.4	260	310	250	300	1290	630	435	285	172
10'x48"	39800	30000	52500	67500	16.2	21.2	300	400	300	400	1690	810	560	367	221
12'x48"	66000	45000	83000	106000	14.7	19.2	500	600	500	600	2550	1210	840	850	330
12'x120"	80000	70000	152000	196000	14.7	19.2	1040	1160	1100	1200	4900	2340	1630	1060	640

(1) Capacities given are for grinding material wet of average grindability. For hard materials the capacities should be reduced, and for softer materials — increased.
(2) Dry grinding capacities are 80 to 90% of the above capacities. (3) Normal operating ball charges for mill with air classifiers are 5 to 10% below minimum listed.

REPRESENTATIVE PERFORMANCES OF RUGGLES-COLES DRYERS

TYPE AND SIZE	XA-10	XA-14	XA-14	XA-18	XB-8	XB-14	XF-12	XF-14	XH-8	XW-2
Material	Zinc Slimes	Coal	Stone	Ore	Clay	Clay	Asbestos Rock	Stone	Flotation Concentrates	Ammonium Sulphate
Moisture in material fed, %	43	11.8	8.9	14.2	27.3	19.8	7.93	5.2	12.5	1.75
Moisture in material discharged, %	22	1.1	0.7	4.7	0.7	1.3	0.66	0.3	3.2	0.11
Temperature of outside air, deg. F.	70	65	75	40	50	70	75	47	38	48
Temperature of fan exhaust, deg. F.	140	168	145	165	226	221	170	390	355	107
Temperature of material fed, deg. F.	60	63	70	48	58	64	70	50	41	72
Temperature of material discharged, deg. F.	210	245	280	220	237	248	160	360	238	142
Type of fuel or heating medium	Oil	Coal	Coal	Oil	Coal	Oil	Oil	Coal	Oil	Steam
Calorific value of fuel, b.t.u. per lb. or gal.	151,000	13,900	14,000	144,000	12,405	138,000	140,000	14,000	140,000	940
Fuel consumed per hour, lbs. or gals.	40.2	715	940	143	280	65.8	260	1,260	24.7	290
Horsepower required for dryer drum	11	48	53	73	12	54	50	56	10.5	6
Horsepower required for dryer fan or fans	8	9	9.5	16	4.5	16	11	11	3.5	3.5
Capacity, dried material per hour, lbs.	11,000	46,000	76,400	98,500	3,915	18,500	160,000	104,000	13,100	5,300
Water evaporated per hour	4,080	5,580	7,096	10,906	1,414	4,267	12,800	5,375	1,392	90
Water evaporated per lb. or gal. of fuel	102	7.8	7.55	76.2	5.05	64.8	49.3	4.27	56.3	0.31
Fuel per ton (2,000 lbs.) of dried material, pounds or gallons	7.30	31.1	24.6	2.91	142	7.1	3.26	24.3	3.77	109

HARDINGE ROD MILL DATA

Size of Mill	Weight in Pounds			R.P.M, Mill		Horsepower				Capacity	
	Mill	Lining	Rod Charge	Min.	Max.	To Run Min.	To Run Max.	Motor Min.	Motor Max.	Tons/24 Hr. Wet Grinding ¾" to 20 Mesh	Tons/hr. Dry Grinding ¾" to 10 Mesh
2'x4'	5000	3000	1700	32	43	5	6	5	7½	27	1
3'x6'	10000	10000	6000	25	34	15	18	15	20	80	3
4'x8'	16000	20000	14000	21	29	33	40	35	40	180	6
5'x10'	32000	31000	27000	18	25	60	80	75	100	350	12
6'x10'	42000	41000	40000	16	19	90	115	100	125	510	18
7'x12'	58000	57000	68000	14	17	150	185	150	200	830	23
8'x12'	71000	70000	90000	12	15	190	240	200	250	1070	30
9'x12'	87000	85000	115000	11	13.5	240	300	250	300	1340	47
10'x16'	115000	113000	195000	10	12.5	390	490	400	500	2200	77

HARDINGE COUNTER-CURRENT CLASSIFIER DATA—WET CLASSIFICATION

Size Class.	Material	Object	Fineness Mesh			CAPACITY				DILUTION			Sp.g. of Ore	R.P.M. Classifier	HP Req.
			Overflow	Oversize	Feed	Overflow T/24 hr. (dry)	Overflow T/hr. (dry)	Oversize T/hr. (dry)	Feed T/hr. (dry)	Overflow % solids	Oversize % solids	Feed % solids			
18"x4'	Limestone	Closed Circuit with 2'x8" H. Mill	tr. +200 94.7% −325	4.8% −325	.5% +48 28.4% −325	1.2	.05	.2	.25	11	72	55	2.6	2	.1
3'x8'	Quartz Gold Ore	Closed Circuit with 5'x36" H. Mill	tr. +65 64.4% −200	8.5% −200	19.2% −200	50	2.1				84.2	72	2.6	4	.7
5'x12'	Quartz Gold Ore	Closed Circuit with 7'x36" H. Mill	1.6% +100 80% −200	78.4% +100M 7.3% −200	10% +10 18.4% −200	192	8			30	81	78	2.7	2	1.5
6'x14'	Quartz and Porphyry Ore	Pr. Classification, Closed Circuit with 8'x30" H. Mill	3.5% +28	52.5% −28	2.5% +6	520	22	52	74	45	82	74	2.7	2.3	4
8'x20'	Lead Zinc Ore in Limestone	6'x12' Rod Mill to class. in c. c. 6'x8' with B. Mill	6.6% +48 39.8% −200	29.4% +48 8.2% −200	−10 Mesh	1040	43			51	85		3.9	1.5	8

HARDINGE THICKENER DATA

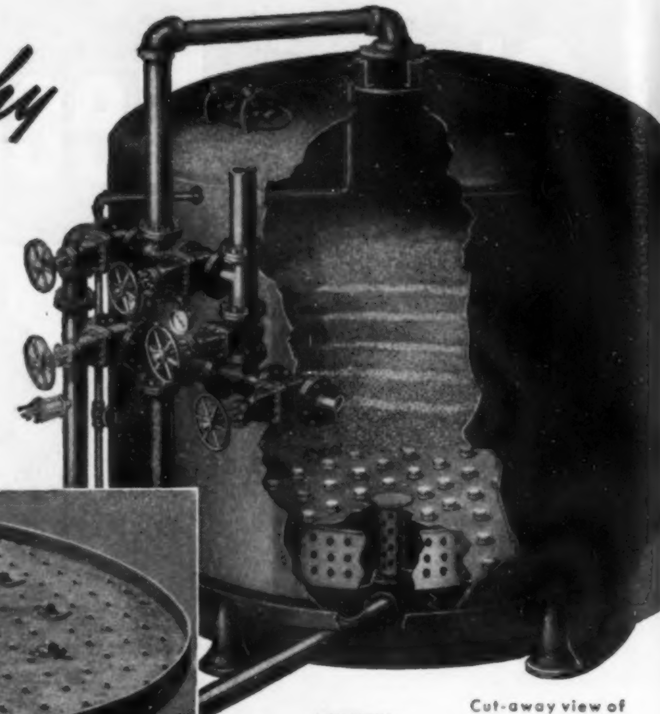
Number and Size Thickener	Material	Object	Mesh Fineness Feed	Feed rate Solution T/24 hrs.	Feed rate Dry solids T/24 hrs.	% solids in feed	% solids Underflow	Settl'g Rt Sq. Ft. T/24 hrs.
1—20'x8'	Zinc, Copper, ead Ore	To thicken Classifier overflow for flotation feed	99.5% −200	400	100	20	40	3.1
1—24'x8' 4—20'x8'	Quartz Ore	Primary thickening and C. C. D. washing Cyanide Treatment	5% +65	180	60	25	58	5
1—40'x12'	Float. Mill concentrates	Dewatering		1050	350	25	56	4
1—60'x10'	Copper Ore Pyrite and Chalcopyrite concentr.	Dewatering and Thickening	100	1680	560	25	75	5

Another reason why

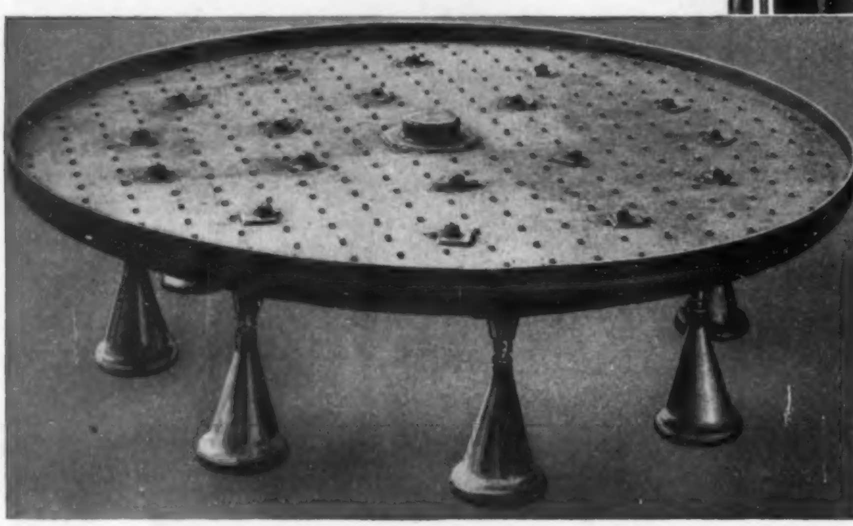
GRAVER

WATER FILTERS

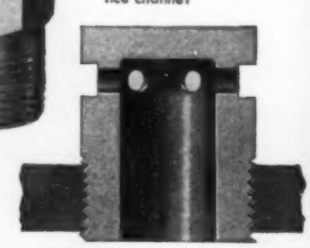
insure highest filtration efficiency



Cut-away view of Graver Water Filter



Above — Strainer plate and stainless steel strainers



Stainless steel strainers showing recessed orifice channel

THE FILTERING CAPACITY of a water filter is based on the horizontal cross-sectional area of the filter bed. Unless the underdrain system provides for even distribution over the entire area, the water will pass through only a portion of the bed and the filtering capacity will be materially reduced.

The strainer plate type of underdrain system as provided in all Graver Water Filters assures even distribution of incoming water and backwash water throughout the entire filter bed. This system is designed so that the use of strainers set on 6" centers distributes the water evenly. In addition, an expansion chamber below the bed assures an even amount of backwash water reaching each strainer. This permits proper backwashing and prevents clogging of the filter bed. It also acts as a collection chamber for filtered water during filtering operation.

Another important point is that all strainers used in Graver Water Filters are made of stainless steel. This type of material positively prevents closing of orifices due to corrosion. Also, the use of stainless steel strainers avoids electrolytic action between strainers and strainer plate.

The Graver type of underdrain system eliminates the need for any concrete grout or fill, therefore, no cracks—no stagnant water—no breeding places for bacteria.

Before you definitely decide on any type of equipment for filtration of water for any use, investigate the advantages offered by Graver equipment.

For further details on Graver Water Filters request Bulletin 313

WATER SOFTENERS
•
FILTRATION SYSTEMS
•
CLARIFIERS
•
SEWAGE EQUIPMENT
•
STEEL STORAGE TANKS
•
VAPOR CONSERVATION SYSTEMS
•
WELDED CONSTRUCTION
•
STRESS RELIEVING
•
X-RAYING
•
FABRICATED STEEL AND CORROSION-RESISTING PLATE

GRAVER

GRAVER TANK & MFG. CO., INC.

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EAST CHICAGO, IND.
CABLE ADDRESS — GRATANK

NEW YORK
CATASAUQUA, PA.

CHICAGO
TULSA

43-21-W

Do you use "distilled" water?

Permutit Demineralizing Process cuts cost as much as 95%!

Composition of Demineralized Water produced
in some commercial installations
(All analyses are ppm as $CaCO_3$)

Plant	A		B		C		D		E	
Water	Raw	Demin.	Raw	Demin.	Raw	Demin.	Raw	Demin.	Raw	Demin.
Calcium and magnesium	43	0	61	0	116	0	120	0	261	0
Sodium	21	3	7	2	33	3	77	4	16	2
Total Cations	64	3	68	2	149	3	197	4	277	2
Bicarbonate	34	3	24	2	58	3	93	4	188	2
Chloride	6	0	11	0	3	0	47	0	14	0
Sulfate	24	0	33	0	88	0	57	0	75	0
Total Anions	64	3	68	2	149	3	197	4	277	2
COST in cents per 1000 gallons	3.0		4.9		8.2		9.5		11.5	

THE table shows the composition of some types of water before and after treatment by Permutit's demineralizing process. Note that the demineralized water is practically indistinguishable from distilled water. Yet the cost, as shown on the bottom line, is so low that almost anyone can afford it. This new "distilled" water offers big savings to present users of distilled water. And because of its low cost, it can be used where distilled water was too expensive. It's an economical form of *insurance* in any processes where chances cannot be taken on the quality of the water used.

The process consists of two steps: In the first, Zeo-Karb H*, an acid-regenerated cation exchanger, replaces metallic cations in the water with hydrogen ion, converting the salts present into the corresponding acids. In the second step, De-Acidite* removes from solution the acids thus formed. Bicarbonates, converted to CO_2, may be removed by degasification.

The new process is the latest of many important contributions to better water conditioning made by Permutit during 30 years of experience. Permutit's service includes the ion exchange materials as well as the design and construction of the equipment. A nationwide staff of Permutit field engineers is constantly on call.

Write for a free bulletin on this or on any phase of cation and anion exchange to The Permutit Co., Dept. K, 330 W. 42nd St., New York, N. Y. In Canada: Permutit Company of Canada, Ltd. . . . Montreal . . . Toronto . . . Winnipeg . . . Calgary. *Trademarks Reg. U.S. Pat. Off.

PERMUTIT

WATER CONDITIONING
MATERIALS AND EQUIPMENT

ION EXCHANGERS
CHEMICALS

Notice how this workman is squinting . . . leaning over in an effort to see Glare in his eyes is the chief cause. No employee can do his best work under such a handicap.

Same workman . . . same machine. But with improved *seeing* conditions he is relaxed and comfortable. This means speedier production, less spoilage, fewer accidents.

These pictures show the meaning of

SIGHT FOR VICTORY

Today in thousands of war plants careful attention to seeing conditions is helping to speed production, reduce spoilage, prevent accidents. Many little things can be done to correct lighting faults and make it easier to see—especially on the night shift.

In order that all of the fighting war plants of America may get the utmost production benefits from their present lighting, a nation-wide "Sight for Victory" check-up has been planned for the month of June. General Electric is glad to cooperate with other members of the Lighting Industry in this effort to help production men check their lighting.

Get Your Copy of New Book SIGHT FOR VICTORY

Some day soon a lighting man plans to bring you a new manual entitled "SIGHT FOR VICTORY", published by the National Better Light-Better Sight Bureau. It tells clearly and simply how to recognize and correct lighting bottlenecks in your plant with the minimum use of critical materials or man-power.

The manual includes a useful Light-Sight check sheet for your convenience. If that lighting man fails to reach you, you can still get your copy by phoning your nearest G-E lamp office. Or ask your G-E lamp supplier or local Electric Service Company. General Electric Company, Nela Park, Cleveland, Ohio.

G-E MAZDA LAMPS

GENERAL ELECTRIC

Tune in the G-E MAZDA lamp radio program Sundays 10 p. m. (Eastern War Time) N. B. C.

Keep on buying U. S. ★ War Bonds and Stamps ★

MISCO
STAINLESS STEEL
PIPE
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TUBES

Centrifugally Cast
2" to 20"

Corrosion Resisting
Heat Resisting

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MISCO Centrifugally Cast Tubes are adaptable to many uses in the chemical process industries and are recommended for Pump Liners • Sleeves • Valve Seats • Shafting • Retorts • Fittings • Bushings • Rings of all kinds • Burner Pipes • Conveyor Rolls • Chemical Piping and many other applications requiring cylindrical castings.

Consult Misco on any present or future problem which involves stainless steel pipe and tubes. Misco engineers and metallurgists may save you valuable time and expense.

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Heat and Corrosion Resistant Alloys

One of the World's Pioneer Producers of Chromium-Nickel Alloy Castings

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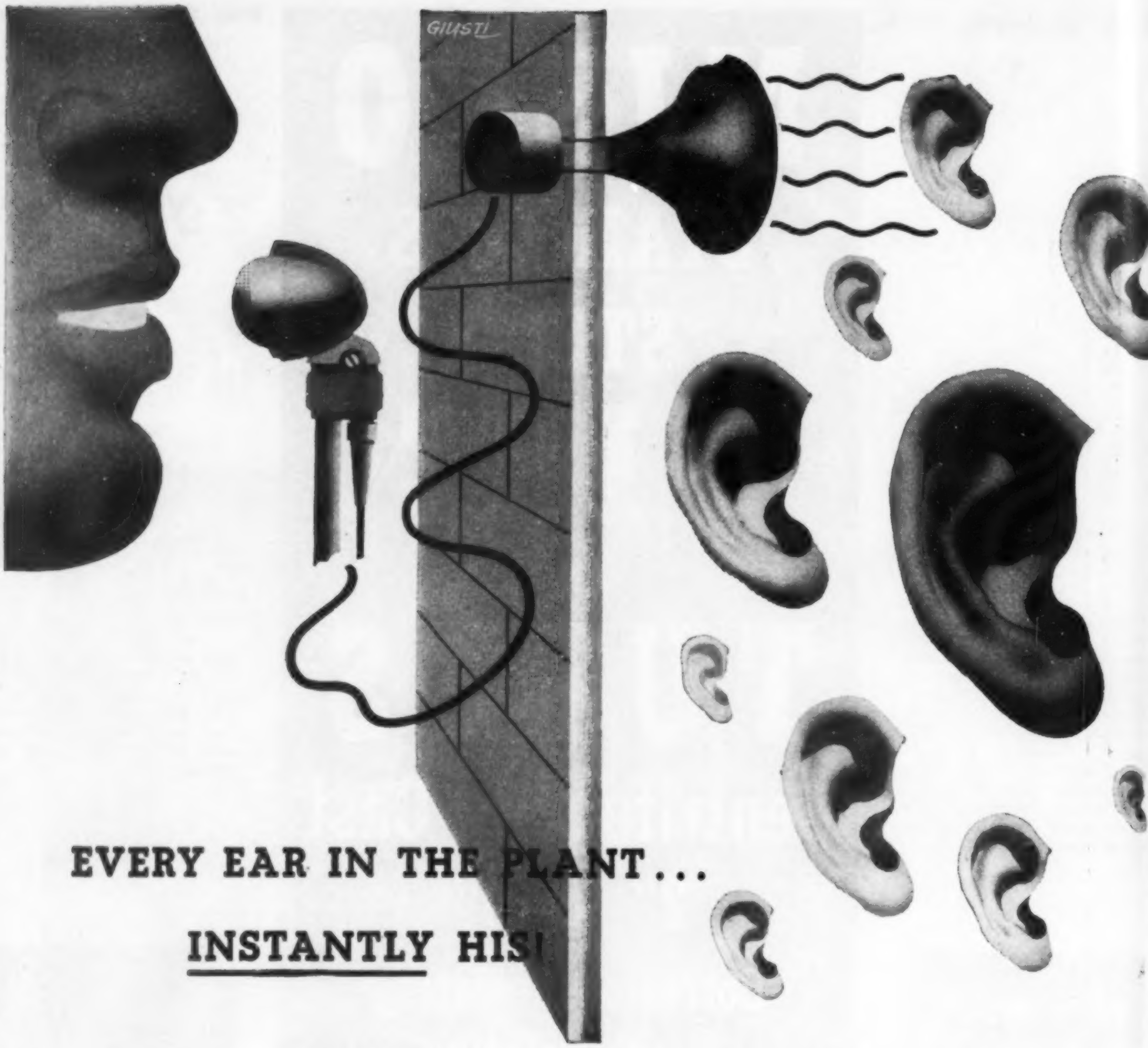
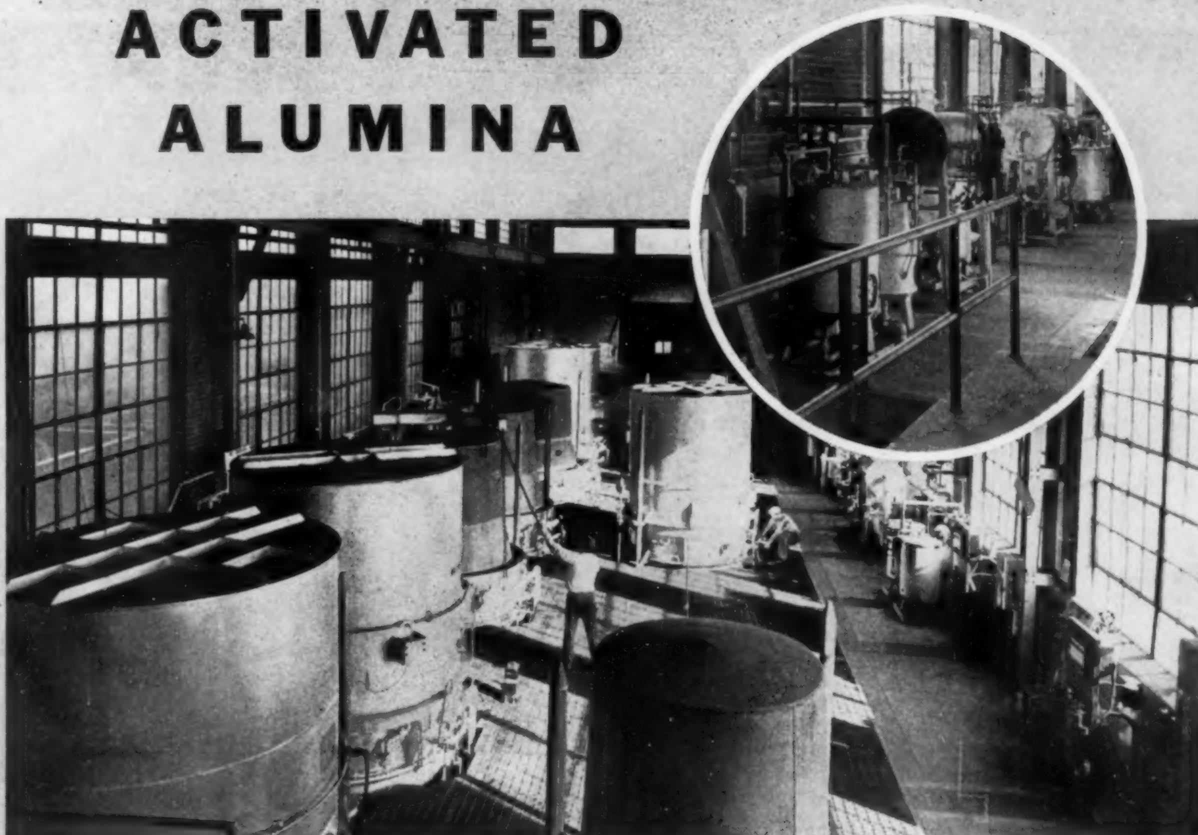

GIUSTI

For *Bright Annealing*, furnace atmospheres are dried with

ACTIVATED ALUMINA



Lectrodryers, charged with Activated Alumina, dry furnace atmospheres in Atlantic Wire Company's annealing department.

They wanted furnace atmospheres maintained at a dewpoint between –45° and –50° C! That's how painstaking Atlantic Wire Company are to see that nothing happens to slow down or impair vital war production.

Moisture in these gases would cause decarburization of the steel being treated. That is why Lee Wilson Engineering Company, Inc., designers and engineers, specified dependable Lectrodryers —charged with Alorco Activated Alumina—for this drying job. The deoxidizing gases employed are dried DRY before being fed into the furnaces.

So again, as in hundreds of other cases, one of the Activated Aluminas is speeding the war effort by providing efficient, certain drying. In many processes, they are helping to increase yields and recoveries. Constant quality is maintained. Corrosion caused by the presence of moisture is eliminated and the life of equipment lengthened.

Alorco Activated Aluminas dry organic liquids, air or gases to dewpoints below –110° F. And they also remove acids from oils and other liquids. Perhaps there's a place for Activated Aluminas in your plants and processes. We'll gladly help you decide. Write ALUMINUM COMPANY OF AMERICA, (*Sales Agent for* ALUMINUM ORE COMPANY), 1910 Gulf Building, Pittsburgh, Pa.

"ALORCO" ALORCO PRODUCTS

Reg. U.S. Pat. Off.

ACTIVATED ALUMINAS

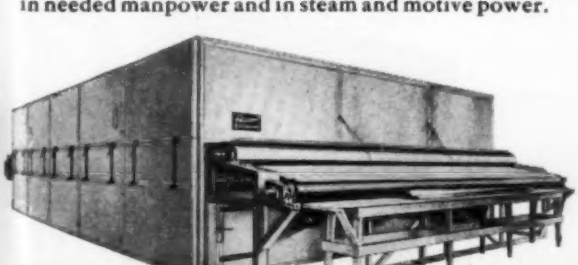
CHINES · PROCTOR DRYING MACHINES · PROCTOR DRYING MA

PROCTOR DRYERS

ARE RECOGNIZED

BY LEADING VENEER MANUFACTURERS

Shown below is the Proctor Type "C" Veneer Dryer. It is especially designed for handling face veneer. It handles any thickness from 1/28" to 1/100". It handles small pieces and pieces up to 16 feet long. The flitch is delivered in rotation, allowing immediate crating. Veneer is in much better condition than when dried by other means. Moisture is removed uniformly all over each sheet. Veneer is not discolored on removal from crate. This modern Proctor Machine also assures great savings in needed manpower and in steam and motive power.



Just as the men of the Navy *recognize,* from experience, the dependability and super-efficiency of their instruments of war, leading veneer manufacturers *recognize,* also from experience, the all-around advantages of Proctor Dryers. Today, the proper drying of the veneers that go into gliders, planes and combat boats is essential. For maintaining absolute drying uniformity and keeping output up to the highest possible levels with minimum cost, Proctor Veneer Dryers are unparalleled. Whether it be for veneer, food, tobacco, soap, plastics, paint, synthetic rubber or a score of other major products, Proctor Dryers are custom-built to do each job *right.* If you have a drying problem, now is the time to have Proctor engineers consider its solution toward that day when other-than-war products can be purchased. Naturally, if your product is vital to the war effort, we can supply you with new machinery today.

PROCTOR & SCHWARTZ • Inc • PHILADELPHIA

CHINES · PROCTOR DRYING MACHINES · PROCTOR DRYING MA

Circle Ⓛ Heat Treated Carbon Steels

"Pinch Hit" for Critical Low Alloys

HAVING trouble obtaining critical low alloy castings? Investigate the possibilities of Circle Ⓛ Heat Treated Carbon Steels! These steels meet specifications for machinery, structural and other castings where high strength is extremely important.

Lebanon's heat treatment of Circle Ⓛ Carbon Steels develops nominal ductility and impact resistance as well as high strength. Physical properties are excellent. Circle Ⓛ-A will meet many war production requirements. Circle Ⓛ-C and Ⓛ-D are satisfactory emergency "pinch hitters" for low alloy structural steels.

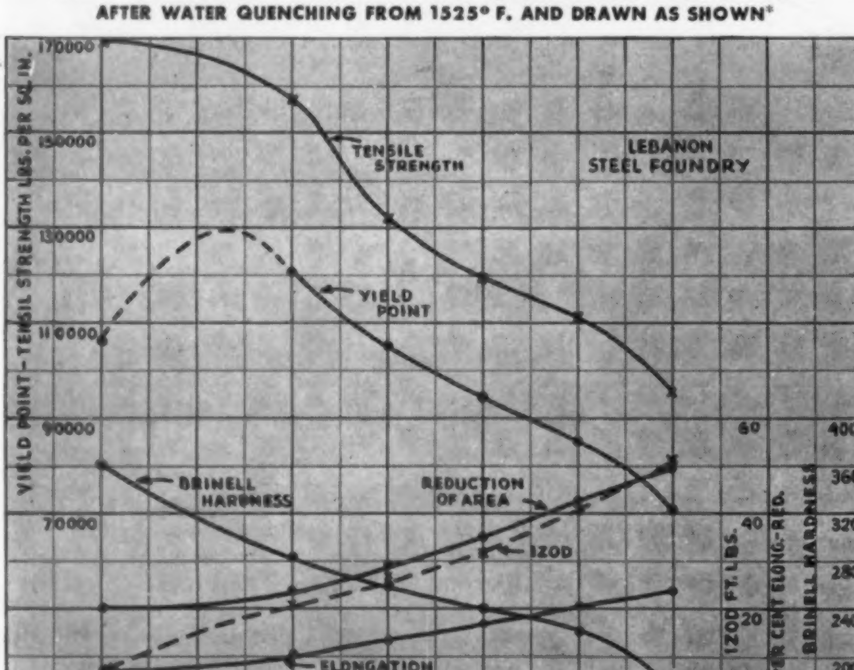
Lebanon offers these emergency materials to aid war industries who require critical low alloy steels but who cannot extend the necessary priorities to procure critical low alloy steels.

Lebanon foundry engineers and metallurgists have had close contact with war production requirements since the beginning. Their experience in solving today's type of industrial problems is available to interested organizations.

LEBANON STEEL FOUNDRY
LEBANON, PENNA.

ORIGINAL AMERICAN LICENSEE GEORGE FISCHER (SWISS CHAMOTTE) METHOD

AVERAGE PHYSICAL PROPERTIES OF CIRCLE Ⓛ HEAT TREATED CARBON STEELS AFTER WATER QUENCHING FROM 1525° F. AND DRAWN AS SHOWN*



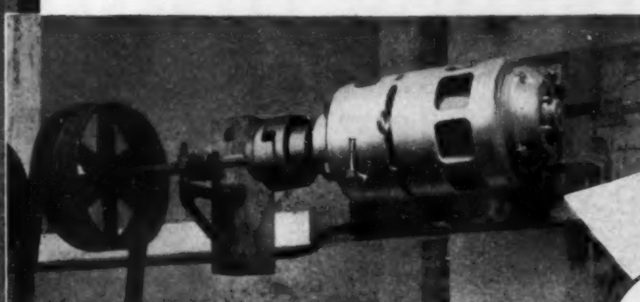
SPECIFICATIONS MET BY LEBANON Ⓛ EMERGENCY CARBON STEELS

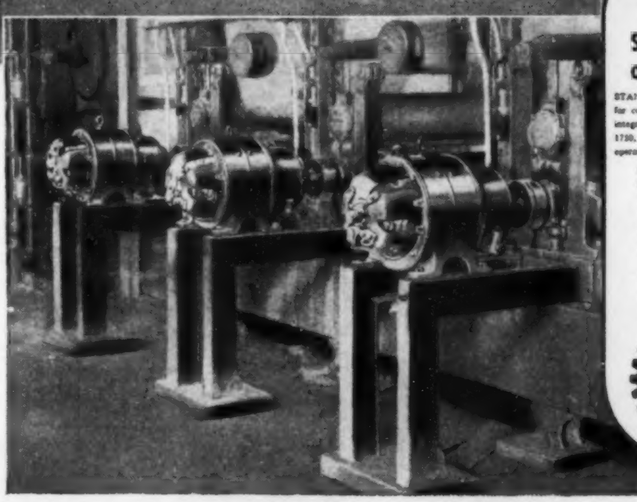
Lebanon Designation	Federal Specs.	U. S. Navy Specs.	S.A.E. Specs.	A.S.T.M. Specs.	Nominal Analysis C.	Si.	Mn.	Heat Treated to Give Following Physicals (Min.) T.S.	Y.P.	El.	Red.	B.H. (Avg.)
Regular Heat Treatment												
Ⓛ-A	QQ-S-681b Class 3	49-S-1 Class A	1040	A-27-39 Grade H-1	0.40	0.40	0.70	80,000	40,000	17	25	170
HIGH TENSILE—Special Heat Treatment—(Liquid Quench and Draw)												
Ⓛ-C*					0.40	0.40	0.70	100,000	75,000	15	30	200
Ⓛ-D*					0.40	0.40	0.70	125,000	85,000	10	20	250

*Restricted to 1½" sect. max.

Lebanon
STAINLESS AND SPECIAL ALLOY
Steel Castings

for *LINE DRIVES* or *DIRECT CONNECTED DRIVES* make your choice Philadelphia MOTOREDUCER





★

A.G.M.A.
STANDARD
OUTPUT SPEEDS

STANDARD OUTPUT SPEEDS for concentric and parallel shaft integral hp Gearmotors. Based on 1750, 1430 or 1165 rpm motor operating speeds.

1430	190	25
1170	155	20
950	125	16.5
780	100	13.5
640	84	11.0
520	68	9.0
420	56	7.5
350	45	6.0
280	37	5.0
230	30	4.0

AGMA

The compact design of the Philadelphia MotoReduceR with its motor and speed reducer in a single housing greatly simplifies installation, and makes it an ideal choice for service where other types of drives are impractical. Furthermore, its rugged construction assures dependable, trouble-free performance with little attention. This has been proven by the countless units in service in all kinds of industrial plants during the past decade. Philadelphia MotoReducers are made in both horizontal and vertical types, in a wide range of horsepowers and ratios, with practically any available motor construction. Get our catalog MR 40 for details.

PHILADELPHIA GEAR WORKS

INDUSTRIAL GEARS
AND SPEED REDUCERS
LIMITORQUE VALVE CONTROLS

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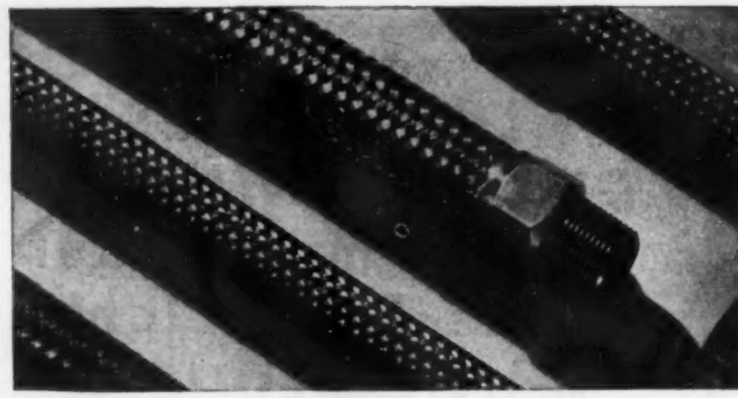
Philadelphia **LIMITORQUE CONTROL** operates all types of valves, etc., safely, economically, from convenient stations.

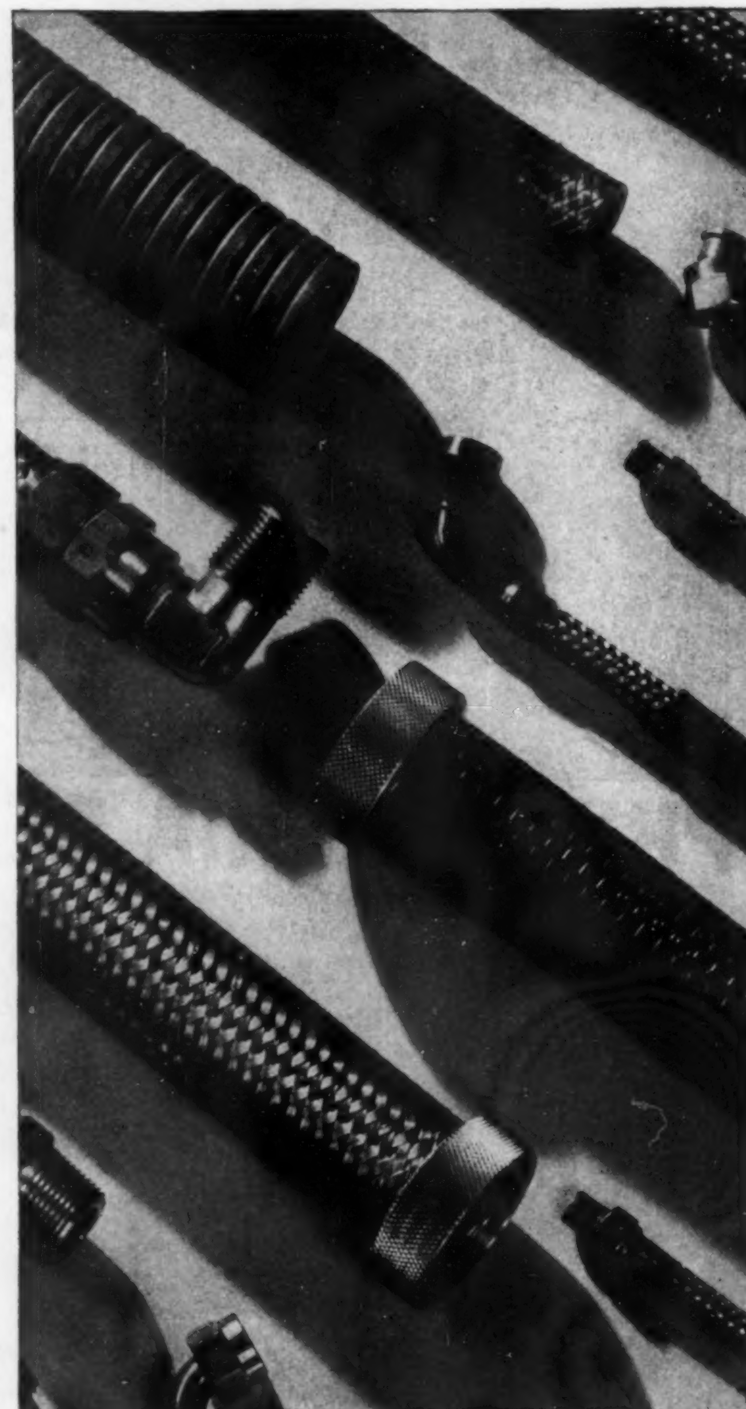
Philadelphia **GEARS** All types and sizes of industrial gears. Can be supplied in all materials.

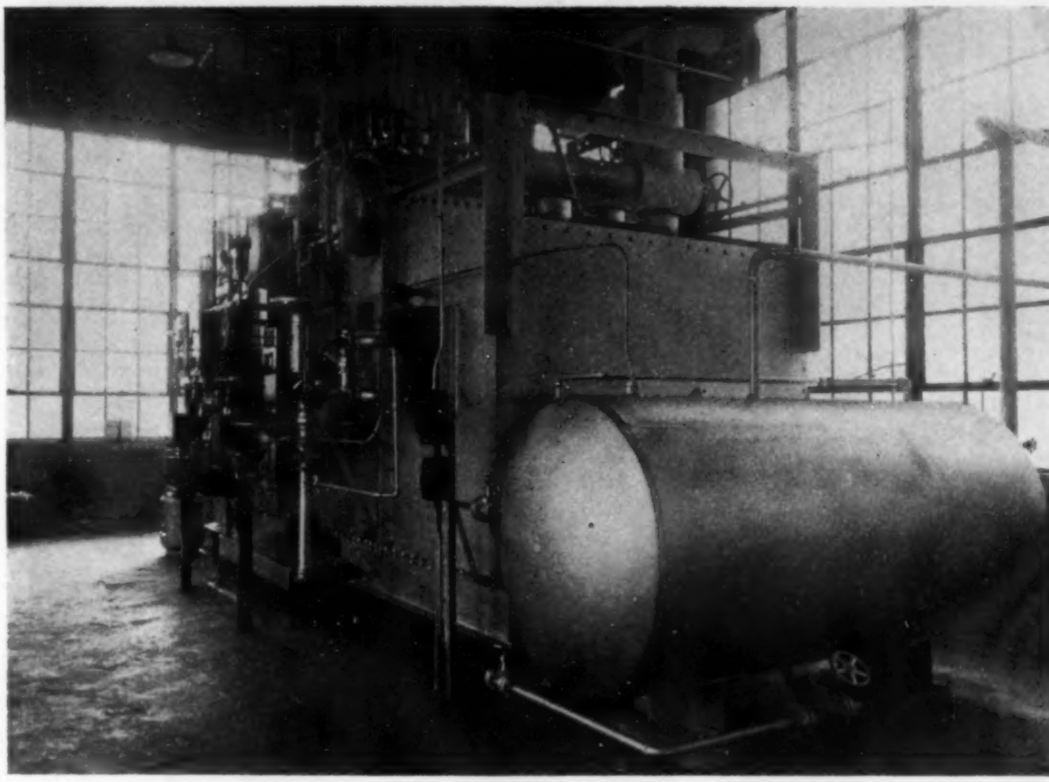
Philadelphia **HERRINGBONE SPEED REDUCER** for heavy loads at high speed. Single, Double, Triple Reductions, various ratios and horsepowers.

Philadelphia **MOTOREDUCER** The economical self-contained drive, Horizontal or Vertical types — various ratios and horsepowers.

Philadelphia **WORM GEAR SPEED REDUCER** right angle drives — vertical or horizontal. Wide range of ratios and horsepowers.







Two 2,000,000 Btu. per hour Dowtherm Vaporizers of a large chemical company.

DOWTHERM ALSO GOES TO WAR

The applications of Dowtherm Industrial Processing had been highly developed prior to Pearl Harbor when units were already in defense production. Since then, a total capacity of more than 395,000,000 Btu. per hour has been built for war output.

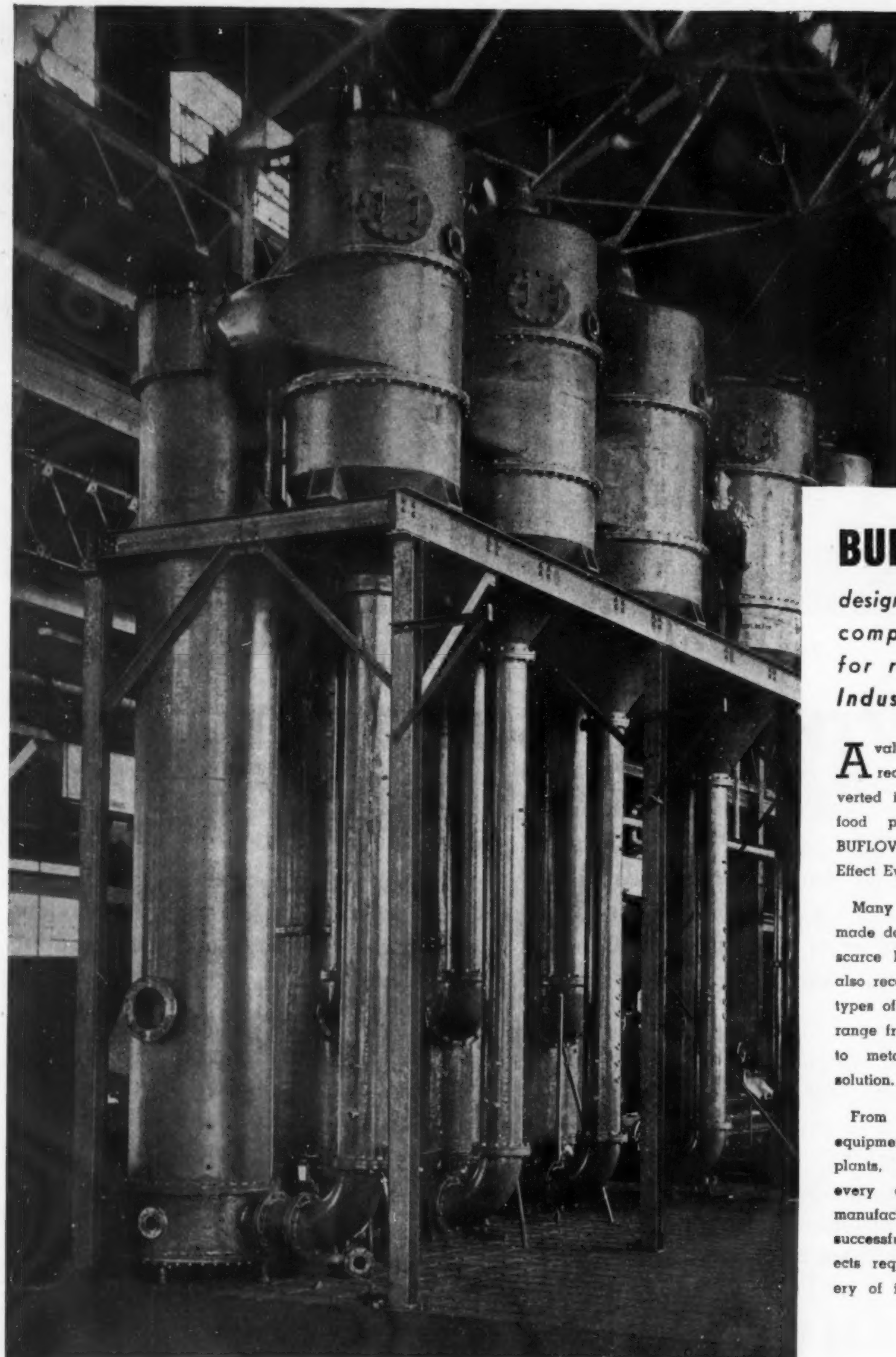
Dowtherm systems operate at high temperatures but low pressures and permit close control of product heating from 400 to 700 deg. F. This indirect heating medium maintains all processing surfaces at a uniform temperature through utilization of latent heat in condensing vapor as compared with temperature variations when direct heating is employed.

Simplicity of operation is greater than with comparable steam systems; the safety factor is higher and the operating costs lower.

Dowtherm Heating Systems are widely used in such processing as: deodorization of vegetable oils, bodying of varnish, asphalt heating, distillation of fatty acids, petroleum distillation, melting of tin, concentration of high boiling point solutions, synthetic rubber processing and sulphuric acid concentration.

FOSTER WHEELER CORPORATION • 165 BROADWAY, NEW YORK, N. Y.

FOSTER FW WHEELER



How to get the most out of your

CROSBY RELIEF VALVES

No. 3 *Reconditioning Seating Surfaces*

After a relief valve has been in service for some time, it may be necessary to refinish the seating surfaces. Severe damage must be remedied by machining, but in the usual case lapping will suffice.

Necessary Equipment: Lapping Blocks, one for each orifice size valve; Lapping Compound of various grades — see table; a Surface Plate for truing up the blocks.

In all operations as well as in the care of the equipment, cleanliness is essential. Foreign particles on the surface plate may scratch the lapping block, and if on the block, they will scratch the valve seat. Likewise a few particles of #200 compound mixed in with the finer grades will cause scratching.

For lapping the valve seat use the following guide:

1. Select the size of lapping block proper for the valve orifice letter.
2. Check the block on a surface plate to make sure it is perfectly true.
3. Apply compound to the block and rotate with an oscillating motion — do not carry through a complete revolution. Let the weight of the block do the work as any applied pressure may be unequally distributed. If the seat is considerably pitted or scratched, use #200 compound, otherwise #500 will do.
4. When most of the damage marks have been lapped out, remove all compound from the seat and from the block, and clean both thoroughly with kerosene. This is important.
5. Repeat this procedure using progressively finer compound, until all marks are gone and the seat has become polished.
6. Never grind the disc against the nozzle. To avoid galling and grooving seats, lap each piece separately, using block as above.

It is a good idea to use different lapping blocks (or opposite sides of the same block) for different grades of compound.

For further information we invite you to write to your local Crosby office for "Instruction for Installation Maintenance and Adjustment of Relief Valves."

LAPPING BLOCK

RECOMMENDED VALVE SEAT LAPPING COMPOUND

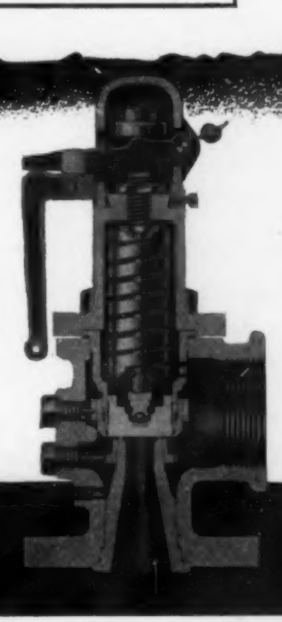
COARSE — No. 200 Mesh Carborundum — or equivalent — for rough grinding of badly scored seats.

FINE — No. 500 Mesh Carborundum — or equivalent — for finish grinding for steam, oil, and general service.

VERY FINE — Levigated Alumina — for highly polishing seats when valve must be tight on hard-to-hold media such as propane, Dowtherm, etc.

No. 3 of Crosby valve maintenance "tips" for improving valve performance and increasing valve life.

Crosby manufactures a complete line of relief valves. They stay bottle tight over long periods, have high capacity, operate accurately and surely and have minimum slowdown.



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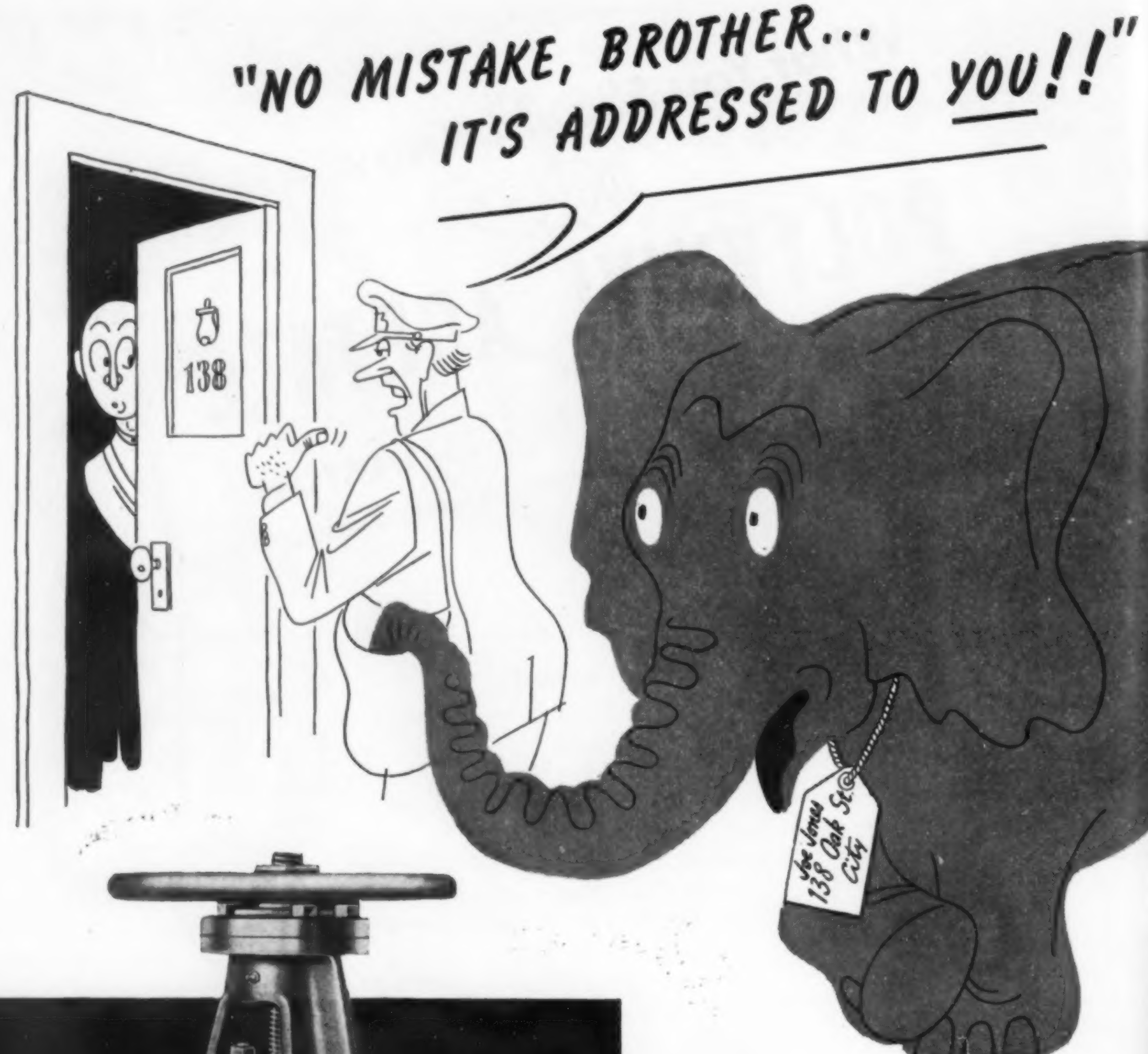

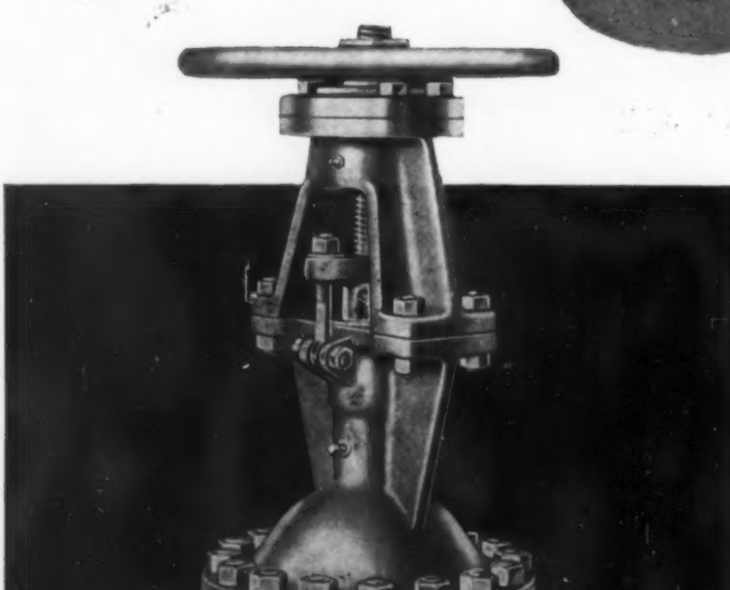

When new products or new processes leave o
your doorstep a valve problem that looks too bi
or strange to handle with any but special equip
ment . . the first move always is to put that prob
lem up to Chapman. For chances are that Chapma
has met it before and has it well in hand . . . *pre*
solved for you with standard equipment availabl
without undue cost or delay. That's because man
valves and fittings, which were specials to begi
with, have been continued as regular types. An
this applies to valves of steel, iron, bronze, an
also chrome and molybdenum alloys. So if yo
run into a "white elephant", don't build it a spe
cial hangar until you've checked with Chapman

ARMY E NAVY

THE
CHAPMAN VALV
Manufacturing Company
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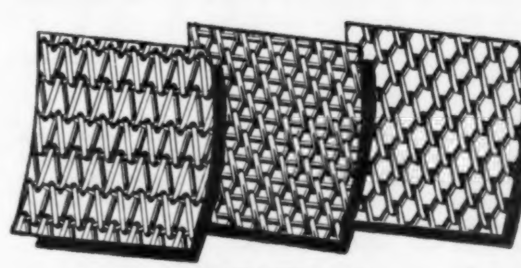
Inferno-Proof Conveyor Belts

The fact that these modern conveyor belts stand up in the inferno of shell-hardening furnaces gives you some idea of the way they can cut time and costs in a host of other applications.

Every Wissco Flexible Metal Belt has back of it 45 years of accumulated experience and pioneering. Each is custom-engineered and manufactured to meet the requirements of a specific job—high or low temperature, abrasion, chemical or other gruelling punishment.

Send for free book "Wissco Metal Conveyor Belts." Wickwire Spencer Steel Company, 500 Fifth Avenue, New York—or Buffalo, Chicago, Worcester, San Francisco.



WHAT DESIGN?

Let Wissco Belt engineers study your conveying problem and specify the best design for your use.

TYPICAL PRESENT APPLICATIONS

Annealing Ovens
Hardening Furnaces
Brazing Furnaces
Degreasing
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CONVEYOR BELTS FOR EVERY PURPOSE

Absenteeism is no problem on the Dust Shift—which works 24 hours a day, every day, if you'll let it—sabotaging operations, increasing rejects, wearing out equipment and slowing down the efficiency of employees.

Maybe this gang is on your payroll without your realizing it. It nearly always is, wherever *engineered dust control* is not on the job.

The American Air Filter Co. has specialized in atmospheric and process dust control equipment for more than 23 years. Why not use this experience to definitely determine if you have a dust condition either troublesome or dangerous that should be controlled? There's no obligation. Meanwhile, send for your copy of "AAF In Industry", a new booklet describing the complete line of American Air Filter equipment and its applications.

Roto-Clone dust collectors are widely used in the Chemical industries. Available in both wet and dry types in a wide range of sizes. Write for Bulletin #273.

AMERICAN AAF AIR FILTERS

AMERICAN AIR FILTER COMPANY, INC., 326 CENTRAL AVE, LOUISVILLE, KY.

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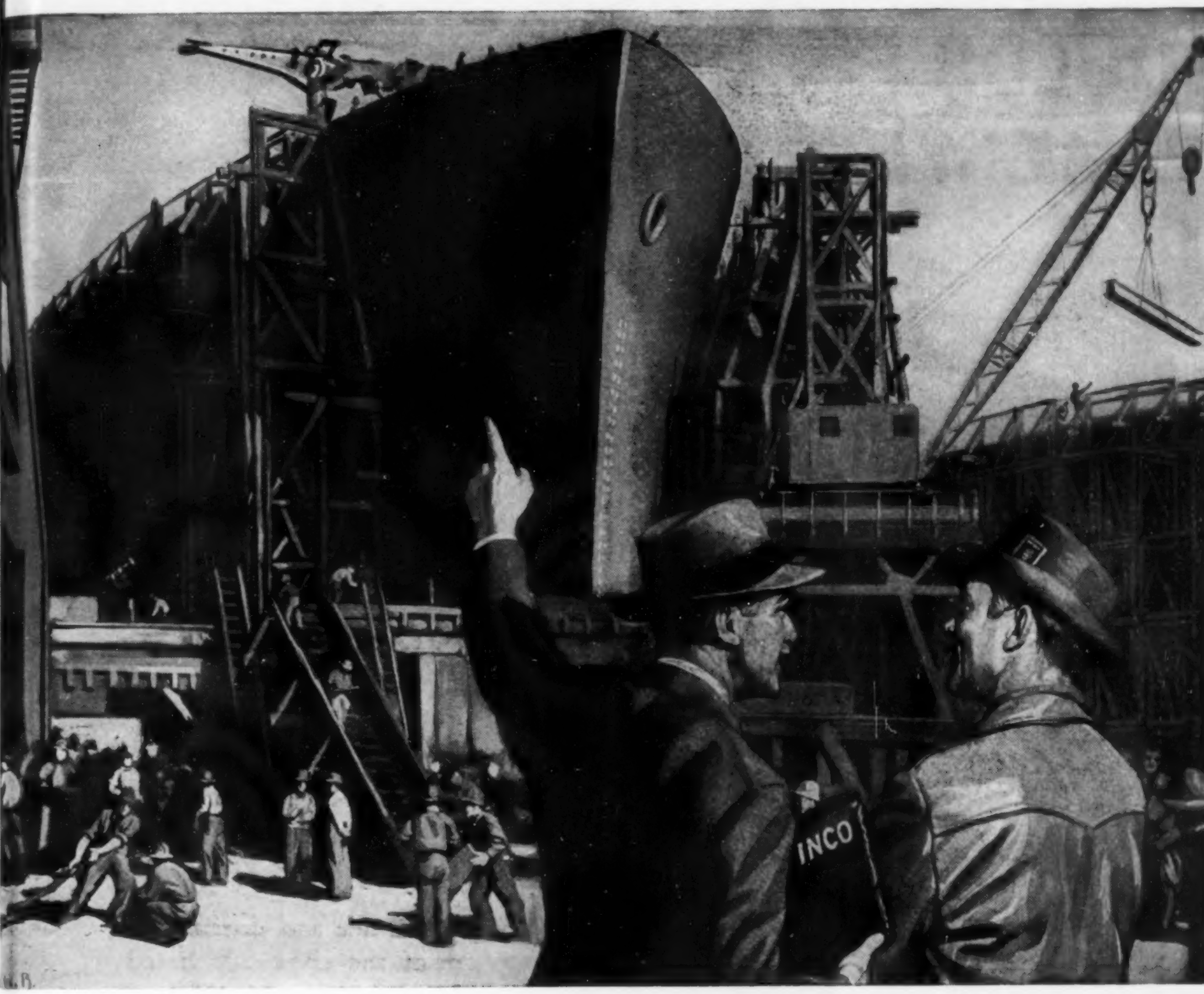
IN CANADA, DARLING BROTHERS, LIMITED, MONTREAL, P. Q.



NICKEL AIDS THE MARINE INDUSTRY
to KEEP 'EM SAILING!

"Uncle *Needs* His Ships." That sign in a shipyard, a thousand miles from the sea, typifies the fighting spirit of America's ship builders. These men will turn out new tonnage faster than Axis bombs and torpedoes can sink it.

In peacetime, their engineering-thinking created efficient power plants that pushed ships of commerce through the seven seas. They designed propelling machinery—turbines, valves, pumps and gears—to move the ship and intricate instruments to guide and guard it on its important mission.

From turbine rotors to propeller shafts, from reduction gears to condenser tubes, those engineers relied upon ferrous and non-ferrous alloys strengthened and toughened by additions of Nickel. They used the properties of Nickel to fight corrosion and fatigue.

During wartime, when uninterrupted operation of America's bridge of ships means so much, the continued and widespread use of Nickel is convincing evidence of its many advantages. Now that sea-going metals must withstand repeated demands for stepped-up performance, a little Nickel goes a long way to insure utmost dependability.

FOR VICTORY BUY UNITED STATES WAR BONDS AND STAMPS

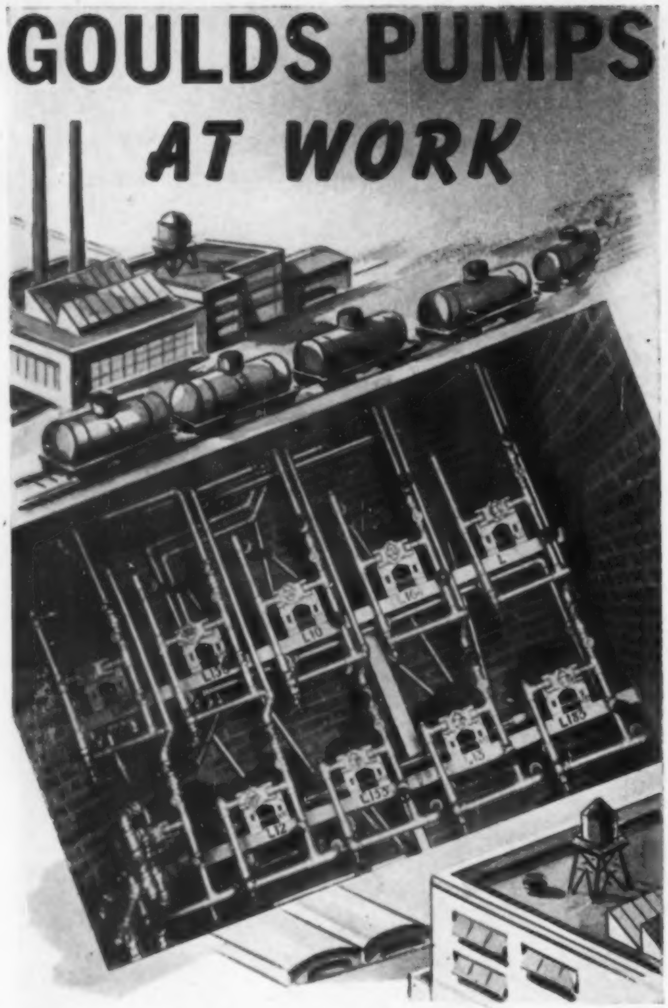
Marine engineers and designers have long known and builders and fitters... as well as repair crews at bases 'round the globe... are learning that, properly used, a little Nickel goes a long way to "keep 'em sailing."

For years the technical staffs of International Nickel have been privileged to cooperate with the men who build and operate ships of all types. Counsel, and printed data about the selection, fabrication and heat treatment of Nickel alloyed materials, is available upon request.

*** *Nickel* ***

Send for lists of available publications. Address your inquiries to Technical Library Service

THE INTERNATIONAL NICKEL COMPANY, INC., *67 Wall St., New York, N. Y.*



Here are ten Fig. 1845 Goulds Rotary Pumps handling solvents, naphtha, alcohol and thin oils in a North Carolina paint plant. They are used for unloading tank cars, filling storage tanks and transferring liquids to various points in the plant for processing.

Thousands of Goulds Pumps in the process industries . . . handle acids, alkalies and other chemicals *under all conditions* efficiently and economically.

In planning post-war plant conversion and expansion for the new generation of industries which will be born after VICTORY, experienced engineers will specify Goulds Pumps. They have learned that *performance* and low maintenance costs are inherent features . . . a result of 95 years' experience in making pumps—and nothing but pumps.

Goulds Industrial Line meets every process industry pumping requirement. For full information and accurate recommendations, write to Goulds!

3799

OLDBURY

ELECTRO-CHEMICAL

COMPANY

SODIUM CHLORATE

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POTASSIUM CHLORATE

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POTASSIUM PERCHLORATE

THE sale and distribution of the chemicals listed above are covered by General Preference Order M-171. Our New York Office will be pleased to advise customers regarding the Preference Order, and furnish the necessary forms.

Plant and Main Office:

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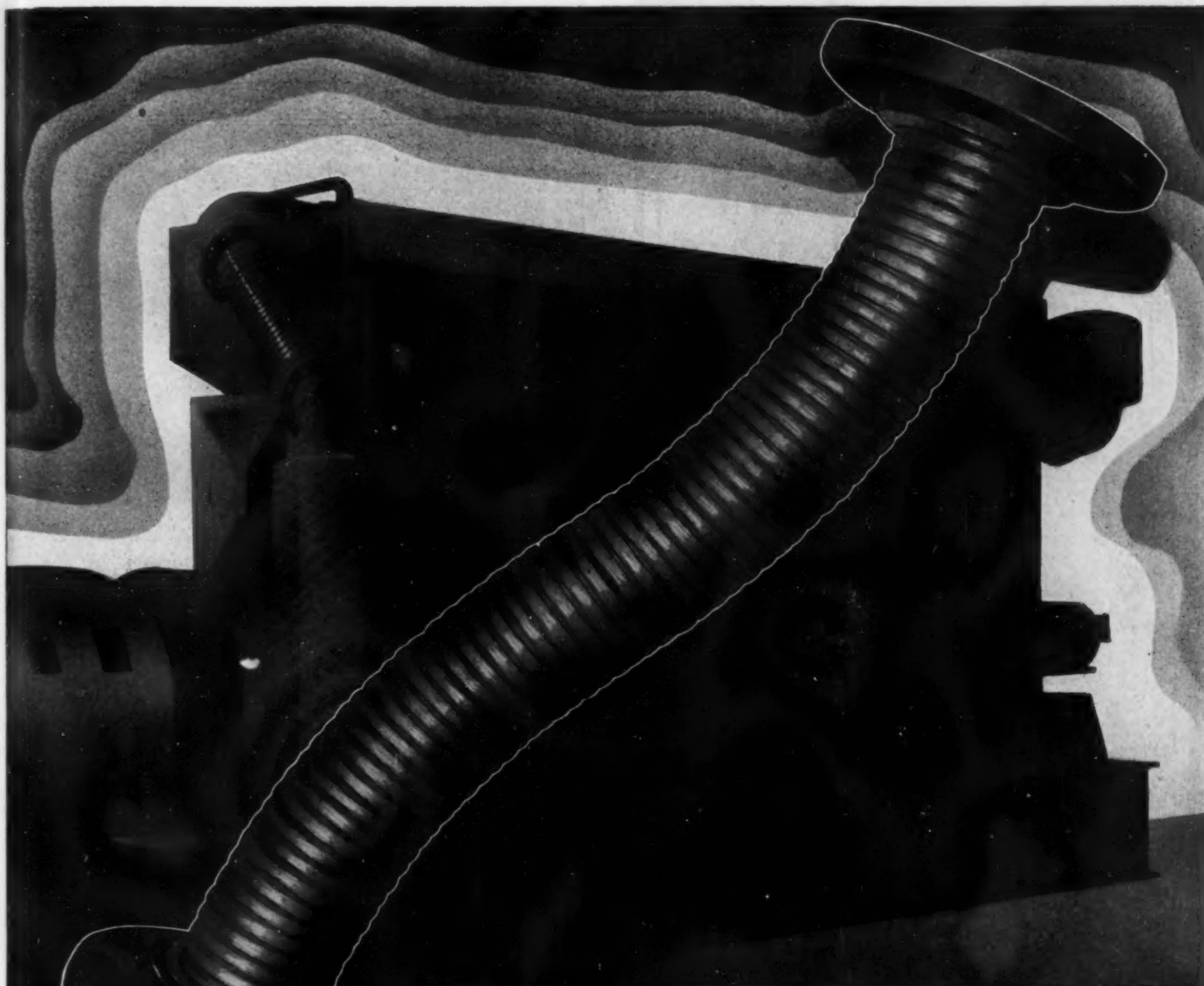
New York Office:

22 EAST 40TH ST., NEW YORK CITY



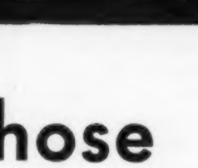
An exhaust hose that isn't easily "exhausted"

Once installed, American Diesel Engine Exhaust Hose stays on the job for years . . . absorbing vibration, providing permanent tightness against seepage, deadening noise, compensating for expansion and contraction caused by the terrific temperature changes encountered in exhaust lines.

Here's why American stands up so well in this unusually severe service: essentially this hose is a flexible pipe. Made of heavy galvanized steel, it is spirally wound so that each convolution becomes fully interlocked with the next. A continuous packing, fed into a prepared groove, insures permanent tightness. And because it's flexible, it's easy to install. American also furnishes flexible metal tubing for fuel, air and starting lines on Diesels.

In addition to Diesel duty, many other types of American Flexible Metal Hose and Tubing serve war industries with distinction, some by conveying oil, steam, gas and water; others as a vacuum service for removing filings and dust, as protective armor and to shield electric wires, and in a thousand and one other important applications.

Whatever your needs in metal hose or tubing, you'll likely find one in the American line that will help you do the job just a little bit better. Your inquiries are invited. 43201



American Interlocked — wound of strip metal, joints packed; the toughest type of extremely flexible metal hose.

AMERICAN METAL HOSE BRANCH OF THE AMERICAN BRASS COMPANY
General Offices: Waterbury, Connecticut
Subsidiary of Anaconda Copper Mining Company
In Canada:
Anaconda American Brass Ltd., New Toronto, Ont.

ANACONDA

American Metal Hose

Make AO YOUR Arsenal for ALL Your Eye Protection Needs

Protecting workers' eyes from industrial hazards calls for systematic study, careful analysis, long-term planning. No matter how competent you are to set up and carry on an eye protection program in your plant, AO can bring you additional constructive help, valuable cooperation.

We invite you to take full advantage of our facilities. Call for the services of a trained AO Safety Engineer. Ask to have a survey made of your plant to uncover *every* eye hazard. Make use of AO posters, unique eye protection charts, and safety literature. Keep a complete AO Safety Equipment Catalog at hand. Depend on rapid, efficient service from a nearby AO branch office. Select the goggles you need from the *complete* AO line—each type scientifically designed for lightest weight and greatest comfort consistent with maximum protection. Get acquainted with an AO Safety Representative—he can help you in your fight against eye accidents.

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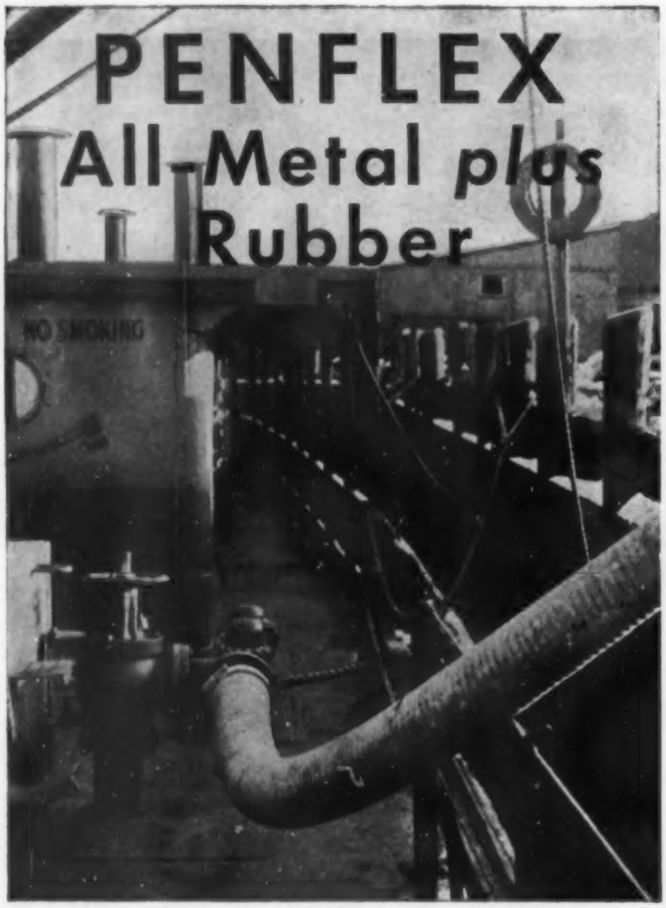

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Penetrative solvents, high volatiles, oils and compressed gases such as butane and propane are carried with safety in PENFLEX, All-Metal plus Rubber, All-Purpose Hose.

Heavy gauge 4-wall interlocking joint PENFLEX, with bronze or steel inner tube made from a single strip of helically-wound metal, flexes without strain; but the metal itself DOES NOT BEND.

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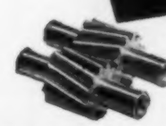

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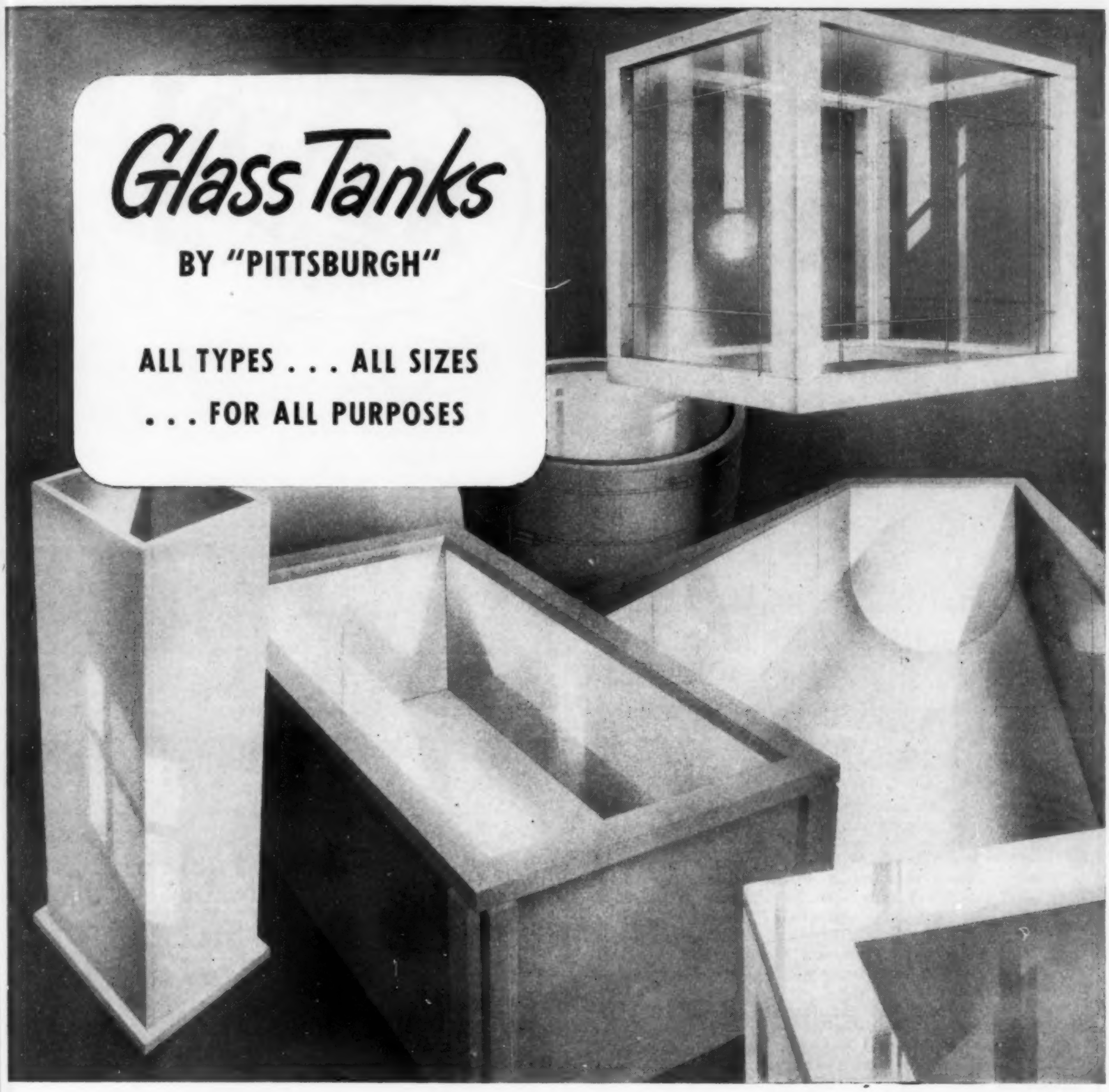

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These "Pittsburgh" tanks are made complete at our factory. But if you want new linings for your own existing tanks, crews of "Pittsburgh" workmen will come into your plant and line your tanks with glass.

Write us, explaining your requirements. And let us work with you on applying glass tanks to your need. Pittsburgh Plate Glass Co., 2053-3 Grant Bldg., Pittsburgh, Pa.

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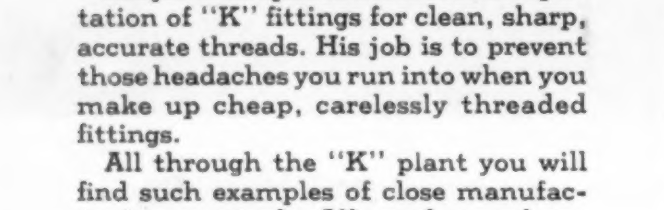

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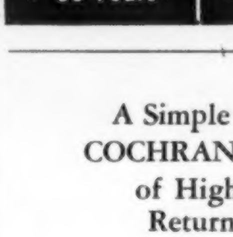

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How to Keep Acids Working for Victory . . . . No. 4

Helping America's process industries win the battle of materiel production is their acid handling equipment. It must stay in the production line—and Tellurium Lead is helping keep it in fighting trim.

* * *

Every plant man concerned with the maintenance of such chemical apparatus recognizes *heat* as Equipment Enemy No. 1. Aside from its effect on the physical properties of corrosion-resistant metals, heat accelerates corrosion. Solutions and gases easily controlled at room temperatures become increasingly destructive as the heat indicator rises.

In a number of plants* Tellurium Lead has made it possible for equipment to operate satisfactorily at temperatures which made short work of the lining and piping materials previously employed. For this reason it is generally recognized as the "high temperature lead."

Evidence of Tellurium Lead's ability to withstand corrosion at the higher heat levels is given by the results of the flash test reported at right.

Undoubtedly one factor contributing to its corrosion resistance at elevated temperatures is Tellurium Lead's stability of grain structure under prolonged heat exposure—see accompanying photomicrographs.

* * *

Tellurium Lead has also been found to perform well under conditions where repeated and abrupt temperature changes, with resulting expanding and contracting forces, subject equipment to recurring stresses. This is thought to be due, among other things, to Tellurium Lead's *work-hardening* characteristic. As this lead is worked, it is toughened—increased in tensile strength.

The work-hardening property of Tellurium Lead is also a safeguard wherever lead must be bent, stretched or hammered, as in elbows, flanges, coils, joints and turnover points.

* * *

Another frequent requirement of acid handling equipment is resistance to vibration. The resultant fatigue stresses, acting in combination with corrosion, are more disastrous than either factor alone. To meet this condition Tellurium Lead not only has the acid corrosion resistance for which lead is noted but also, under vibration tests, it exhibits a 60% greater endurance limit than lead without the tellurium addition.

* * *

Tellurium Lead of our manufacture is time-tested St. Joe chemical lead alloyed with a small quantity of tellurium. It is available in sheet or pipe form, or fabricated in coils for heating and cooling purposes.

For further information address the nearest Company branch listed below.

*TYPICAL CASE HISTORIES

One user of Tellurium Lead reported that eight months after installation, "the lining in our tub showed little if any corrosion due to the action of the 10 per cent boiling sulphuric acid to which it is exposed."

* * *

Another user — whose equipment is subjected to temperatures ranging up to 356° F. — says, "we find Tellurium Lead withstands chemical action to a much greater extent than the material used previously."

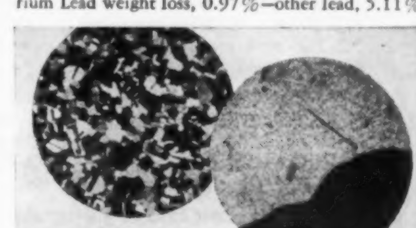
* * *

Another company tried a Tellurium Lead heating coil in a plating tank where the average coil life was ten weeks. The Tellurium Lead coil more than doubled this average — stood up for six months.

* * *

Still another company is using Tellurium Lead to line tanks handling phenolic compounds and sulphuric acid at temperatures ranging up to 376° F. Previous lining materials pitted badly after short service. Several of the Tellurium Lead linings have been in three years and have not yet required repair.

Flash Test: Strips of Tellurium Lead (top) and lead without tellurium (bottom) after immersion in 96% sulphuric acid at 581° F. for 3 minutes. Tellurium Lead weight loss, 0.97%—other lead, 5.11%.



Stability of Grain Structure: Grain structure of Tellurium Lead (top) and lead without tellurium (bottom) after annealing six months at 302° F. The grains of the lead without tellurium "grew" during the annealing; those of Tellurium Lead remained the same size.

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NATIONAL LEAD COMPANY—New York, Baltimore, Buffalo, Chicago, Cleveland, Cincinnati, St. Louis, National-Boston Lead Co., Boston; John T. Lewis & Bros. Co., Philadelphia; National Lead & Oil Co. of Penna., Pittsburgh; Georgia Lead Works, Atlanta; American Lead Corp., Indianapolis; Master Metals, Inc., Cleveland; The Canada Metal Co., Ltd., Toronto, Montreal, Winnipeg, Vancouver.

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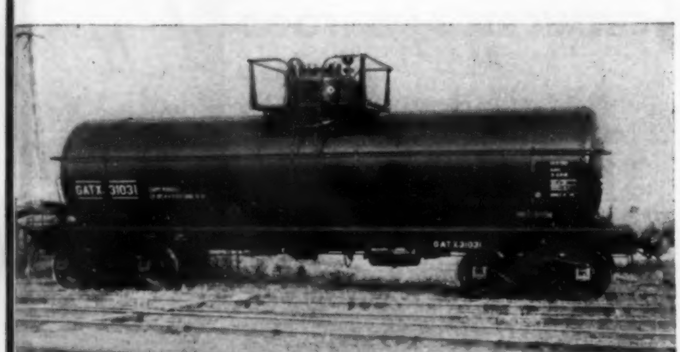

TANK CARS—Nickel-Clad Steel tank cars built by General American Transportation Corporation, Sharon, Pa. These 8,000 gal. cars were built of 5%, 10% and 20% Lukens Nickel-Clad Steel.

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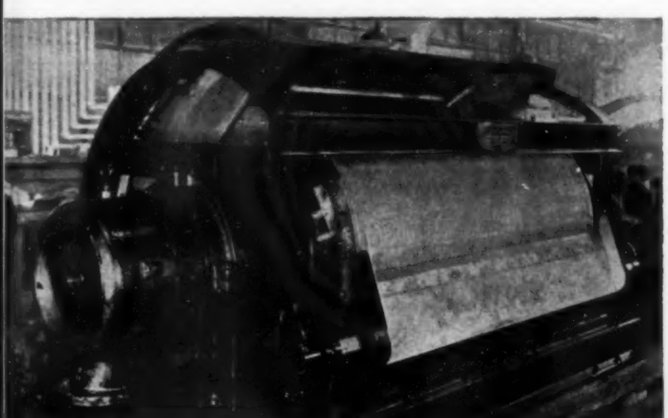
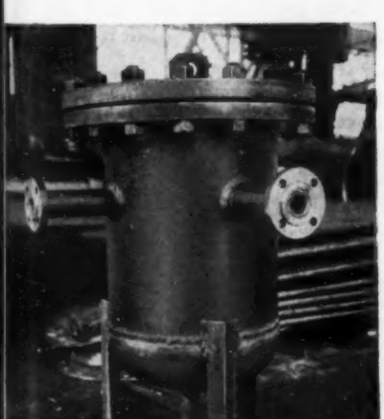
Products are shielded from dangerous contamination. Purity and appearance are preserved. Equipment lasts longer, and needs less maintenance.

Lukens Clad Steels make one pound of nickel, Inconel or Monel do the work of five pounds, ten pounds and sometimes more, as illustrated in equipment on this page.



SALT FILTER—In this 4′ 0″ diameter, 6′ 0″ face salt filter, Swenson Evaporator Company, division of Whiting Corporation, Harvey, Ill., used 20% Lukens Nickel-Clad Steel for parts in contact with the salt.



CATALYTIC TRAP—Edge Moor Iron Works, Inc., Edge Moor, Delaware, fabricated this catalytic trap, 2′ 0″ x 5′ 0″, from 20% Lukens Nickel-Clad Steel.

STRIKE PAN—For cooking glucose in 50,000 lb. batches, this vacuum strike pan, 10′ 0″ diameter and 24′ 0″ high, steam heated, was built by Farrar and Trefts, Inc., Buffalo, New York, of 15% Lukens Nickel-Clad Steel.

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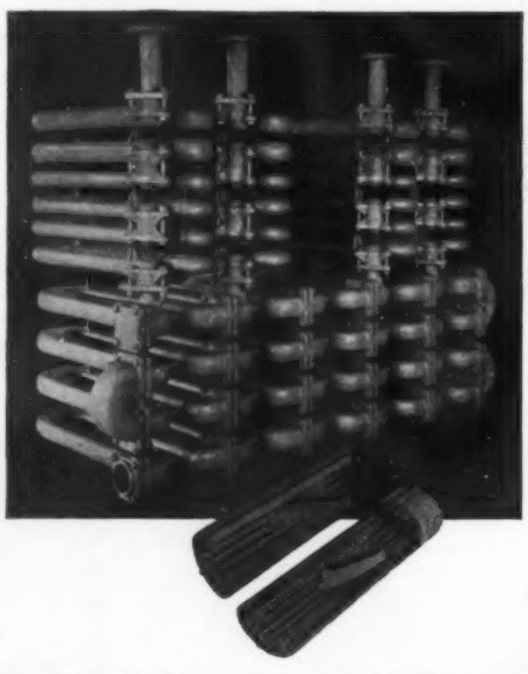

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64	65	78	79	80	81	82		

Name..

Address..

City............................State..............

343-6-43

SEARCHLIGHT SECTION

EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

UNDISPLAYED RATE:

10 cents a word, minimum charge $2.00.
(See ¶ on Box Numbers.)

POSITIONS WANTED (full or part-time individual salaried employment only), ½ above rates.

PROPOSALS, 50 cents a line an insertion.

INFORMATION:

BOX NUMBERS in care of any of our New York, Chicago or San Francisco offices count 10 words additional in undisplayed ads.

DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED—RATE PER INCH:

The advertising rate is $6.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page.

NEW ADVERTISEMENTS received by 10 A. M. July 6th will appear in the July issue subject to limitation of space available.

WANTED

ENGINEERS

MECHANICAL
CHEMICAL
POWER
DRAFTSMEN

A major soap company is enlarging its engineering division to develop designs of projects in plant layout, processing and mechanization of finishing operations for a long-range program.

Opportunity for advancement and permanence for those who can qualify and are not now employed in essential industry at highest skill.

P-574, Chem. & Met. Engr.
330 West 42nd St., New York City

WANTED

DRAFTSMEN

Men acquainted with machine layout and process piping. Permanent position in rayon plant located in beautiful section of the southeast. Essential War industry. Applicants please state age, education, previous experience and salary desired; photograph or snapshot not returnable.

American Enka Corporation
Enka, N. C.

WANTED

CHEMISTS — WOMEN

Several positions in Research Division available for well trained women chemists, with large eastern chemical manufacturer. Principal activities now on war projects, but positions have permanent opportunity with progressive organization. Submit full particulars.

P-552, Chem. & Met. Engineering
330 West. 42nd St., New York City

POSITIONS VACANT

AMERICA IS AT WAR! Due to the war program, we have found it necessary to increase our production facilities and our staff. We have an opening for a non-ferrous metallurgist. State full qualifications in first letter. Largest smelter in the Middle West engaged in 100% War Work. P-527, Chemical & Metallurgical Engineering, 520 N. Michigan Ave., Chicago, Ill.

Due to increased production of war materials, largest smelter in Middle West in increasing its staff. Permanent position open for secondary brass reverberatory furnace foreman. State full qualifications in first letter. P-528, Chemical & Metallurgical Engineering, 520 N. Michigan Ave., Chicago, Ill.

LARGEST SMELTER in Middle West is looking for secondary aluminum foreman for reverberatory furnaces. Permanent position. 100% war work. State full qualifications in first letter. P-529, Chemical & Metallurgical Engineering, 520 N. Michigan Ave., Chicago, Ill.

FIRE PROTECTION ENGINEER and Inspector. Permanent positions open in New York, Pennsylvania, or the Middle West with large industrial fire insurance organization. Previous knowledge in this work not necessary. Applicant must be a technical graduate with manufacturing or engineering experience, and possess a good personality. Send photo with letter. Men subject to draft for military service cannot be considered. P-558, Chemical & Metallurgical Engineering, 330 W. 42nd St., New York, N. Y.

CHEMIST OR CHEMICAL ENGINEER who is now engaged in non-defense industry but who desires work on process improvement, development and research in Plant vital to war effort. Products equally necessary in peace time. Plant located in Detroit area. State fully qualifications, references, salary required, and draft status. P-559, Chemical & Metallurgical Engineering, 330 W. 42nd St., New York, N. Y.

CHEMICAL ENGINEER for development work in large sulphate pulp and paper mill in southeast coastal area. Should have at least 2 years paper mill experience. Give full details as to experience, age, salary expected, etc. Those now engaged in war plants will not be considered. P-560, Chemical & Metallurgical Engineering, 330 W. 42nd St., New York, N. Y.

INSTRUMENT MAN experienced with instruments for recording and controlling flows, pressures, temperatures, levels, etc. Large pulp and paper mill located in southeast coastal area. High hourly rate. Vacation with pay. Give full details as to status and experience. Those now engaged in war work will not be considered. P-561, Chemical & Metallurgical Engineering, 330 W. 42nd St., New York, N. Y.

SALES MANAGER, general steel plate and structural product—Gulf States. Write giving full information, experience, salary. P-562, Chemical & Metallurgical Engineering, 520 N. Michigan Ave., Chicago, Ill.

SALES MANAGER, general steel plate, structural, and allied fabrication—Middlewest. Must have engineering background, also executive and organizing ability. Write giving age, education, experience, salary, and references. P-563, Chemical & Metallurgical Engineering, 520 N. Michigan Ave., Chicago, Ill.

WANTED: Prospective or recent graduate. Mechanical or Chemical Engineer, male or female, to assist in office of Plant Engineers of large manufacturing concern. Work will consist of maintaining running charts of production, river conditions, consumption of power, steam, water, etc., preparing periodic reports, preparing lists of equipment from inventories, investigating abnormalties in plant maintenance, etc. P-566, Chemical & Metallurgical Engineering, 330 W. 42nd St., New York, N. Y.

WANTED

ENGINEER

PRODUCTION DEVELOPMENT

ON THERMO-SETTING RESINS

Unusual opportunity for chemical engineer to work with variety of resins and make a reputation for himself in this progressive company. Man must have worked 3 or more years in production or production development of thermo-setting resins. Experience in manufacture of varnish resins also important. Job with essential war industry and established business in Northern New Jersey. If full skill now employed in war work, do not apply. Write stating experience, education, age, and salary desired. Box 487 Equity, 113 W. 42d St., N. Y.

(POSITION VACANT)

COMMERCIAL RESEARCH

We want a man well acquainted with Chemical Manufacturing and Process Industries for Commercial Research Work on new Chemical Products. Apply by letter.

PENNSYLVANIA SALT MANUFACTURING COMPANY
Market Research Department
1000 Widener Bldg., Philadelphia, Pa.

WANTED

Chemists and Chemical Engineers

Several openings for both chemists and chemical engineers in Research and Development Department of large eastern chemical manufacturer. Attractive opportunities on war projects; also extensive peacetime program gives ample opportunity for permanent position with progressive Company. In reply, state full particulars including draft status, training, experience, salary, etc.

Address P-553, Chem. & Met. Engineering
330 W. 42nd St., New York City

WANTED

EXPERIENCED INORGANIC CHEMIST

(all metals) to take charge of lab. Steady job and excellent opportunity to advance. State experience and salary expected.

P-572, Chem. & Met. Engr.
330 W. 42nd St., New York, N. Y.

Executives, Engineers, Chemists and Metallurgists!

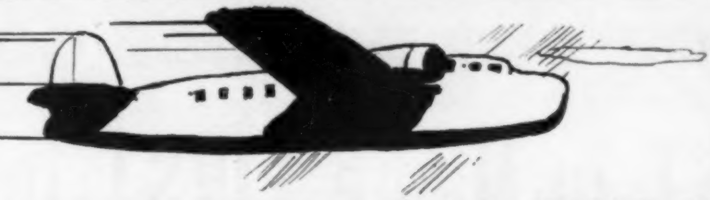
Qualified men wanted for openings throughout the United States. Write for application or submit experience record.

Inquiries solicited from responsible employers. All negotiations confidential. Est. 28 yrs.

HARRISON PERSONNEL SERVICE
20 W. Jackson Blvd. CHICAGO

Additional Employment and Business Opportunity Advertising on page 352

MODERN TIME-SAVERS



"CONSOLIDATED"

The Transcontinental Plane spans the continent in fewer hours than the weeks taken by the Covered Wagon.

shrinks weeks and months to days or hours in getting you the Equipment you want for War Production. At a substantial saving, too! Save Time to Save America!

1—PROCTOR & SWARTZ, 9-Truck Atmospheric Dryer, 40 trays per truck, 1562 sq. ft. tray surface.
4—300 gal. COPPER CLOSED TIN-COATED TANKS.
1—NICKEL LINED TRUCK TANK, 1000 gal.
6—3-ROLLER MILLS, up to 16x40.
8—4000 lb., 2000 lb., 1000 lb., 800 lb., 600 lb., other smaller sizes.
2—Creason Morris 48" copper basket, direct m.d. CENTRIFUGALS, ball bearing.
1—W & P MIXER size 18, 500 gal., jacketed type VIM Class CC; 7—size 15, 100 gal., jack., type VI, Class BB; and other sizes.
9—KELLY FILTERS, #150, #250, #450.
12—OLIVER FILTERS, 4'x6', 6'x6', wood and iron; 8'x8', 8'x12.

OVERHEAD ELECTRIC TRAVELING CRANES

1—5 ton P & H 3 motor OET crane, 47' span, 25' lift with 60' runway and legs.
1—2 ton Lakeside 3 motor 47' span, 25' lift, 330' steel runway
1—2 ton American monorail, 3 motor, 25' lift, 60' span.
All motors 3 ph. 60 cy. 440 V. These cranes are still in service and can be seen in operation.

1—PEBBLE MILLS: 1—Patterson, 6'x7' Silex Lined; 1—32"x42" rubber lined; other sizes.
4—VIBRATING SCREENS: TYLER HUMMER 4'x5' No. 39.
5—RAYMOND PULVERIZERS: 5 Roll High Side; No. 1 Beater Type; No. 0000.
BELT CONVEYORS: 24"x105'; 30"x132'. Also 2—12" with Belts Ball Bearing Idlers, steel frame-work, drives, etc. 120' 125', all c.c.

A USABLE MACHINE STANDING IDLE IS A WORSE "ABSENTEE" THAN HUMAN LABOR

Send us your list now! Help us fill the demand!

LIQUIDATION
Former LION BREWERY
108th St. & Columbus Ave., New York, N. Y.

3—Vilter AMMONIA COMPRESSORS, twin horiz., 250 tons each, direct motor driven to West. 500 HP synchr. Motors, 3/60/440 V.
1—Vilter AMMONIA COMPRESSOR, 40 tons, motor driven with West. 100 HP 3/60/440 V.
WOOD TANKS, good as new—
23—Horizontal, 10' dia. x 23' long, 3" staves, 14,000 gallons.

BREW & BOTTLING EQUIPMENT

Miscellaneous: 8,000 gal. Jacketed, Agitated Kettles, Boilers, Pumps, Keg Equipment, Rubber Tubing, Tons of Pipe, Valves and Fittings.

Send for Printed Circular

Arrange to Inspect—Representative on premises

2—All-copper EVAPORATORS: 1—Badger Triple 450 sq. ft. per effect; 1 standard triple 450 sq. ft. per effect; 1—Standard Triple 350 sq ft. per effect.
1—4'6"x16" Hardinge Conical BALL MILL, iron-lined, with motor and ball charge.
2—SWEETLAND #12 FILTERS 4" C. C. 36 iron leaves, late style, vertical fittings.
1—SPERRY 42"x42", CAST IRON FILTER PRESS, plate-frame, 55 chambers; 1—SHRIVER 30"x30", washing, 60 chambers; 20 others, 30"x30" to Laboratory sizes.
9—HEAT EXCHANGERS Abilberger: 50, 100, 300, 440 sq. ft. heating surface, also smaller sizes.
10—EVAPORATORS — single, double, triple and quadruple effects, standard makes.
4—ATMOSPHERIC DRUM DRYERS: 1—3'x9' Bronze double drum; 2—Anco 4'x9' single drum; 1—4'x8'.
8—ROTARY VACUUM DRYERS: 1—BUFFALO 5'x30"; 5—DEVINE 4'x25'; 1—DEVINE 4'x30"; 1—STRUTHERS WELLS 30"x12'.
2—ROTARY VACUUM DRUM DRYERS: 1—Buffalo 48"x40" Single Bronze Drum; 1—Devine 3'x9' Double Bronze Drum.
50—25 gal. Monel open TANKS; 12—45 gal.
14—RUBBER LINED Rectangular TANKS: 2—650 gal.; 9—500 gal.; 2—200 gal.; 1—150 gal.

LIQUIDATING
Equipment of
WASTE DISPOSAL & REDUCTION PLANT
BOSTON HARBOR, MASS.

4—5' x 40' Direct Heat Rotary Dryers.

20—Open and closed, Steel Storage and Pressure Tanks, 500 to 17,000 gallons.

18—Digestors, tile lined, cone bottom, 7'5" dia. x 16', 5600 gallons.
3—Barret & Snow Percolators, 8'7" dia. x 15' long.
2—Barret & Snow steam jacketed Reducers, 10' dia. x 4' deep, sweeping agitators.
1—Sturtevant Fertilizer Unit, complete, including grinder, elevator, screen, mixer, etc.
1—Mitts & Merritt CRE No. 15 Shredder, 75 HP motor.
1—Hydraulic Press, 42" platen, with hydraulic pump.
3—250 HP Heine Water Tube Boilers, 150 lb. pressure, Mass. std.
1—Baldwin Steam Locomotive, 27 ton, standard gauge.
1—Curing Chamber, 15' x 21' x 27' high.
Miscellaneous: Steam Pumps, Motors, Steam Engine, Royal Disintegrator, Model C-2

Send for Complete List

10—American Tool 40" steel basket CENTRIFUGALS, bottom discharge.
35—CENTRIFUGAL EXTRACTORS, 12" to 72", bronze and steel baskets, belt and motor drives.
3—Rotary Kilns: 6' x 60', 6' x 80'.
8—ROTARY DRYERS: 3'x20', 4'x30', 5'x30', 6'x40'.
1—100 Ton Carbondale AMMONIA ABSORPTION SYSTEM, complete.

ROTARY DRYERS
Direct Heat

1—5' x 30' Iroquois.
1—6' x 24' Iroquois.
Both ½" shells and complete.

SUPPLYING MACHINERY for the Chemical, Alcohol, Bottling, Brick, Candy, Ceramic, Cocoa, Canning, Chewing Gum, Clayworking, Cosmetic, Crushing, Drug, Textile Dyeing, Printing and Finishing, Distilling, Drying, Explosives, Food Products, Fertilizer, Filtering, Grinding, Glue, Gelatin, Ink, Lacquer, Meat Packing, Oil and Fat, Oil Mill, Paint, Pharmaceutical, Process, Plastic, Paper, Pottery, Pulverizing, Quarry, Rubber, Rectifying, Soap, Sugar, Varnish and all other Process and Allied Industries

CONSOLIDATED PRODUCTS CO., INC.

15 Park Row, New York City — Shops: 335 Doremus Ave., Newark, N. J.

Tel. BArclay 7-0600 — "Every machine in your plant is a used machine" — Cable Address: Equipment, N. Y.

SAVE TIME *to* SAVE AMERICA

FIRST in Name FIRST in Service!

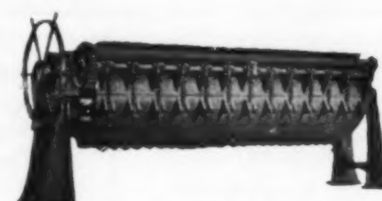
Rebuilt equipment is never better than the firm that rebuilds it! The First Machinery Corporation was the:

FIRST to "really" rebuild equipment to function good as new—*not the paint brush way.*

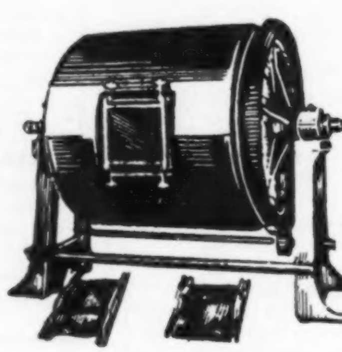
FIRST to install a complete coppersmithing and metal working department.

FIRST to combine offices and plant for closer supervision and cooperation.

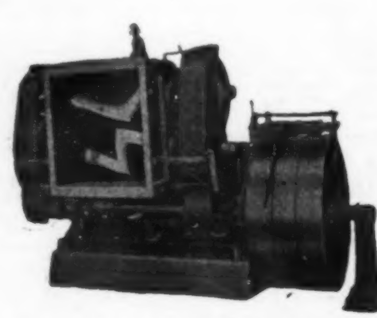
- 1 Copper Column, 38"x37' high, with all auxiliaries.
- 1 Copper Column, 27"x22' high, no auxiliaries.
- 6 Vacuum Stills from 10 gls. to 1000 gls.; some agitated.
- 1 Devine #23 Vacuum Chamber Dryer.
- 2 Devine Rotary Vacuum Dryers; 3'x25' & 5'x30'.
- 2 Louisville Tubular steam heated Dryers, 6'x35'.
- 2 Louisville direct heat Dryers, 6'x25'.
- 1 Judelson Duplex Evapodryer; Tray-Truck type.
- 1 Gehnrich steam heated "Festoon" type Dryer 6' wide, 9'7" high, 20' long; complete with heating elements & controls.
- 6 Mosser Rotary Kilns, tapered type, 7'6"x60'.
- 1 Buffalo Foundry Atmospheric DOUBLE DRUM DRYER; cast iron drums 24" x 36".
- 1 Shriver 24" Steam Jktd. Filter Press, 30 chambers.
- 1 Kelly #450, Cylinder, 4' x 12'.
- 2 CO_2 Brunswick Compressors, motor driven, 20 & 10 ton-M.D.
- 1 Alberger surface Condenser; 920 brass tubes, ¾"ID x 99".
- 1 Westinghouse surface Condenser; 962 sq. ft., brass tubes.
- 1 W & P, 150 gls. unjktd., double arm Mixer.
- 10 Jktd. & Unjktd. Mixers, from 5 gls. to 4000#.
- 30 Buffalo, Gould, Pennsylvania, Taber Rotary & Centrifugal Pumps; ½" to 8", belt, motor and turbine drive.
- WORTHINGTON, DEVINE, AMERICAN Vacuum Pumps; 9"x 8½"x10", 12"x12"x12", 14"x20".
- 1 Steel rotary pressure Digester, 6' diameter by 17' 6" long.
- 2 Allegheny Chrome Steel 6000 gls. Tanks.
- 1 Bufalovak Autoclave; jktd., 750# pressure.
- 2 Mikro No. 4 Pulverizers, 24"; with 60 & 75 H.P. motors.
- 15 Raymond, Bauer, Stedman, Williams, Gruendler, Schutz-O'Neill mills and grinders.
- 1 Lard Cooling Roll, 3'x6'.



Sweetland Filters



Pebble Mills from 5 gls. to 1200 gls. porcelain & silex lined.



W & P 50, 100, 150 gls. jktd. & unjktd. mixers.

FMC FIRST MACHINERY CORP.

EAST 9th STREET & EAST RIVER DRIVE, NEW YORK,

This is only a partial list

send us your inquiry!

Send for "FIRST FACTS"

LIQUIDATION *Buy Now!*

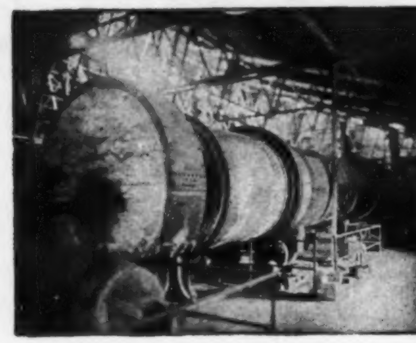
EQUIPMENT FORMERLY OWNED BY

VULCANITE *Portland Cement Co.*

ALPHA, N. J.

3 miles from Phillipsburg, N. J. and Easton, Pa.

• KILNS

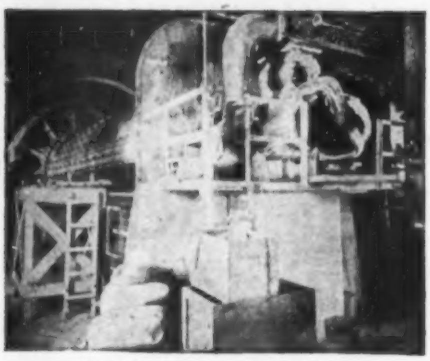


Vulcan Iron Works Steel Rotary Kilns

3—Vulcan Iron Works steel rotary kilns, 8'6"x7'6" dia., 125' long, fire brick lined.
1—Vulcan Iron Works steel rotary kiln, 7'6"x7' dia., 125' long, fire brick lined.
7—W. F. Mosser & Son steel rotary kilns, 5'6"x5' dia., 60' long, fire brick lined.

NEW SPARE PARTS FOR ALL ITEMS

• MILLS



Allis Chalmers 7 x 30 Tube Mill

1—Williams mill, size 3.
5—No. 8 Krupp steel ball mills, spur geared, with counter shaft.
1—Allis Chalmers Compeb Mill, complete, gear driven from counter shaft through magnetic clutch, and with induced fan ventilation and dust collectors.
14—30" Griffen Mills.
1—5x20 Smidth steel ball mill.
26—42" Fuller Lehigh pulverizers, each with belt idler.
3—33" Fuller Lehigh pulverizers, each with belt idler.

NEW SPARE PARTS FOR ALL ITEMS

Steel Balls

120 Ton Steel Balls, ¾" to 5"

Hoists

1—Double drum steam hoist S. Flory Mfg. Co. 11"x14" duplex
1—Westinghouse 60" Single drum hoist

Steel Buildings

24 Steel buildings suitable for re-erection.

Boiler Plant

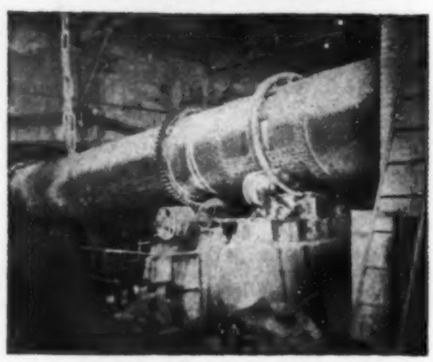
2—800 H.P. Edgemoor Boilers. 200 lb. pres.
4—800 H.P. Babcock & Wilcox waste heat boilers. 200 lb. pres.
2—400 H.P. Babcock & Wilcox W.T. Boilers. 200 lb. pres.
All complete with blowers, feed pumps, feed water heaters, etc.

• CRUSHERS

1—Allis Chalmers Fairmont Roll Crusher, 36"x60".
2—No. 6 Gates gyratory rock crusher.
1—No. 6 McCully gyratory rock crusher, style K.
5—No. 5 Gates gyratory crushers.
1—Mosser rotary clinker crusher.
1—No. 10 McCully gyratory rock crusher with extra gear, eccentric and bell.

NEW SPARE PARTS FOR ALL ITEMS

• DRYERS



W. F. Mosser & Son Steel Rotary Dryers with Steel Stacks

2—W. F. Mosser & Son steel rotary dryers with 65" steel stack.
2—W. F. Mosser & Son steel rotary dryers, 72"x60" dia., 60' long, bevel gear drive, each with counter shaft and 40' steel stack.
1—W. F. Mosser & Son steel rotary dryer, 72"x60" dia., 55' long, bevel gear drive, with counter shaft and 35' steel stack.
1—W. F. Mosser & Son steel rotary dryer, 72"x60" dia., 55' long, bevel gear drive, with counter shaft and 50' steel stack.
1—Ruggles 5'x30' Rotary Dryer.

NEW SPARE PARTS FOR ALL ITEMS

Engine Sets

8—Engine Generator Sets. 800 KW, 750 KW, 575 KW, 475 KW and two 400 KW D.C. sets.

Miscellaneous

4—*Buffalo* forge blowers and exhausters.
Complete Stock Room suplies, New Gears, Bearings, Belting, Safety Switches, Pumps, Shafting, and Pulleys, etc. Thousands feet of conduit.

Air Compressors

1—Ingersoll-Rand 18¼"x14"x18" horizontal duplex air compressor, belted motor drive, with 3'6"x20' riveted steel air receiver.
1—Ingersoll-Rand Duplex Air Compressor, 11"x16"x18" belted motor drive.

Dust Collecting Systems

2—W. W. Sly dust collecting systems, each with exhaust fan, 10 H.P. motor and cyclone dust collectors

STEEL BINS

Steel Plate Storage Bins that can be re-assembled—Order at once. 58 Bins in Various Capacities & Sizes.

Cu. ft.	*Dimensions*
35,184	18'4" x 70' x 27'5" high
19,592	11'3" x 40'6" x 43' high
10,440	12' x 58' x 15' high
9,270	12' x 51'6" x 15' high
7,460	10' x 55'3" x 13'6" high
6,827	12'8" x 44' x 12'3" high

Also various BINS as follows

4—1,650 cu. ft. and under
1—1,116 cu. ft. and under
5— 896 cu. ft. and under
6— 640 cu. ft. and under
7— 532 cu. ft. and under
12— 370 cu. ft. and under
11— 288 cu. ft. and under
2— 95 cu. ft. and under
1— 37 cu. ft.

CONVEYORS

RUBBER BELT

14"—16"—18"—20"—24" and 28" Centers varying from 30' to 203' Some with movable Trippers

STEEL SCREW

6"—7½"—8"—10"—12"—14"—16"—18" and 20" In Steel Box Over 10,000 ft. all lengths.

BUCKET ELEVATORS

Thousands of feet of bucket elevators, all sizes of buckets, mostly all steel encased.

BUCKET SIZES: 10 x 18—10 x 15—9 x 14—9 x 13—9 x 12—8 x 16—8 x 15—8 x 14—8 x 13—8 x 12—7 x 12—7 x 11—7 x 10—6 x 10—6 x 9—6 x 7
With—844; 103; 132 chain from 12' to 60' heights.

NEW BUCKETS and GEARS

Representative on Premises **Phone: Phillipsburg, N. J. 5-1111**

HEAT and POWER *Company, Inc.*

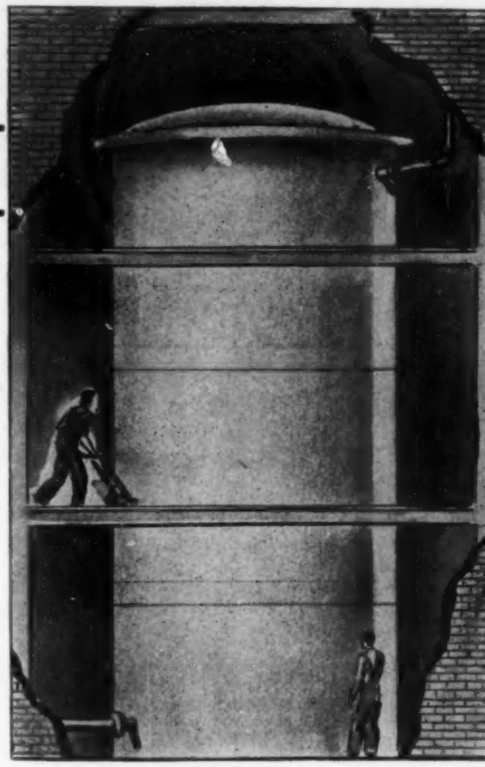
45 BOND STREET *Phone:* **ALgonquin 4-3874** **NEW YORK, N. Y.**

TANKS 10′x25′

HEAVY STEEL

• FOUR HEAVY PRESSURE TANKS—Vertical with Dished Bottom and Removable Cover. Cover locked on with Eye Bolts. Riveted Construction, with two 10" Reinforcing Rings spaced 8 ft. apart.

Can be used horizontally as Vulcanizers, Impregnators, Extraction Tanks, Pressure Processing, Etc.



FOR PRESSURE

Specifications

10 ft. dia., 25 ft. high, exclusive of dished cover and bottom.

Shell ¾" thick.

2—20" Flanged Pipe Connections, 1 Top and 1 Bottom at side.

(One Jacketed)

When you need Equipment...

NITRATORS
RETORTS
AUTO CLAVES
STEEL KETTLES

EMSCO

COLUMNS • PUMPS
EVAPORATING CANS
CRYSTALLIZING PANS
CAST IRON COATING PANS

SPECIALS

PULVERIZERS

2—Size B71.2 "The Briton Grinder" direct connected motor driven 25 HP. 220 Volt 3 ph. 60 cycle AC 2800 RPM Hammer type.

ENGINE GENERATORS

1—250 K.V.A. and 1—300 K.V.A. Crocker-Wheeler Generator direct-connected to Skinner Tandem Compound Steam Engine 480 Volts 3 phase, 60 cycle A.C. 200 RPM plus Switchboard instruments.

Steam Fixtures include Bends and Separators.

KETTLES

3—300 Gal. Stainless Steel Jacketed Kettles with Agitator.

1—Struthers-Wells Kettle 5′-6" x 4′-0" Jacketed —with Agitator & Explosion Proof Motor.

BOILERS

1—444½ HP. Union Iron Works Company double longitudinal drum water tube Boilers. 200 pound pressure. Equipped with Foster superheater. Diamond soot blowers. 1—S.C. regulator Company water column regulator, brick setting, arranged to burn powdered coal.

ROTARY DRYERS

1—5′x40′ Horizontal Rotary Dryer Complete

1—4′ Dia. x 11′ Stokes Jacketed Rotary Dryer with Heavy Ribbon type agitator, Gear Drive.

1-4′x16′ Portable Rotary Dryer Complete

"MANY TANKS," ALL SIZES

EMSCO EQUIPMENT CO.

Emil A. Schroth, Owner

39 HYATT AVE. Phone • MITCHELL 2-3536 NEWARK, N. J.

EQUIPMENT FOR SALE NOW

MIXERS

2—W & P "Uni-Dor" Vacuum Mixers, 75-gals. each.
1—W & P Bronze Mixer, 30-gals.
6—W & P Jacketed Mixers, 100-gals; 1200-gals.
10—Double-Arm Mixers, Wheeler, Day, & W. & P. 15-gals. to 50-gals.
3—Day Mixers, 4'x4'x9½'; 46"x45"x9½".
2—Plastic Kneaders, 4'x7'x12'.

TANKS & KETTLES

1—RECTIFYING UNIT: 48" Fractionating Column, 48" Rectifying Tower—plates, 54" Packed Tower.
1—Steel Bubble Tower, 4'x33½', 2" plate.
1—Welded Aluminum Tank, 3500-gals.
1—Steel Stay-Bolted Tank, 8000-gals., Jacketed.
1—Copper Jacketed Kettle, 3750-gals.
1—Everdur Jacketed Kettle, Everdur Agitator, 2000-gals.
1—Everdur Jacketed Cone-Bottom Kettle, 70-gals.
4—Dopp Kettles, 80-gals. to 300-gals.
25—Jacketed Kettles, 5-gals. to 150-gals.
3—Wood & Steel Lead-Lined Tanks, 600-gals. to 1000-gals.
3—Cast Iron Acid Eggs, 44" I.D. x 8'6" long, 2½" thick.
1—Steel Digester, Jacketed Bottom, 2000-gals.

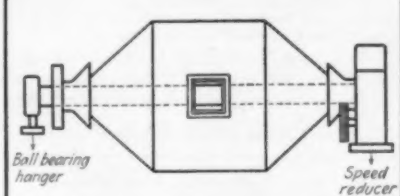
DRYERS

1—Bartlett & Snow Rotary Brick-Lined Dryer, 8½'x50'.
1—Louisville Rotary Steam Tube Dryer, 6'x50'.
1—Rotary Crystal Dryer, 5'x26'.
2—Ruggles-Coles Rotary Direct-Heat Dryers, 54"x 20'.
1—Rotary Vacuum Dryer, 3'x10'.
1—Black & Clawson Two-Drum Dryer, 28"x60".
3—Degreasing Ovens, 7½x6x15'; 9x8x15'.

FILTER PRESSES

2—FEINC Wooden Continuous Filters, 8'8"x6'; 4'x10'4".
1—Sweetland Filter Press, #7.
1—Johnson Jacketed Filter Press, 18x18".
1—Johnson Filter Press, 24x24", recessed type.

6 WATSON MILLS



6—WATSON, GRINDING AND MIXING MILLS

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2—102"x60" dia.
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PULVERIZERS

1—Raymond #1 Impact Pulverizer.
1—Royle #3 Perfected Extruder.
2—Housatonic #6 Extruders.
2—Rotary Cutters, Ball & Jewell & Abbe, #1, #2.

EVAPORATORS

5—Kilby Single-Effect Evaporators, 60—3" brass tubes.
1—Steel Single-Effect Evaporators, 242—2" copper tubes.

MILLS

1—Hardinge Conical Ball Mill, 3' dia. x 3' cyl. length.
2—Abbe Continuous Tube Mills, 4½'x15'.
1—Hendy Continuous Ball Mill, 3'x12'.
3—Abbe, West Pulverizing, Pebble Mills, Lab. to 1000-gals.
7—Three-Roller Mills, all sizes and makes.
1—Five-Roller Mill, National, water-cooled, 20x 40", 16x40".
5—ANCO Continuous Soap Powder Mills, cylinder, 2'x3'.

MISCELLANEOUS

1—Ames 40 KW Steam Driven Generating Set, side crank.
1—Copper Jacketed Still, 50-gals., Condenser & Column.
2—Absorption Ceramic Towers, 36" x 24'.
1—Stearns #2 Magnetic Separator.
1—Terry Back Pressure Turbine, 250 KW Generator.
5—Sharples Pressurite Super Centrifuges.
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2—Steel Autoclaves, Agitators, 1000-gals. each.
2—Grisoom-Russell Sectional Condensers, Size 15-68, 75# Pressure.
2—Steel Heat Exchangers, 44"x7'6", 1" brass tubes.
1—Stainless Steel Combination Washer & Extractor, 3½'x18".
1—Messerschmitt 250-Ton Press.
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Hardinge Pebble Mills 6' x 22"—8' x 30"
Hardinge Ball Mill 8' x 22"
Rod Mill 4' x 8' with motor
No. 1½ Sturtevant Rotary Crusher
Jaw Crushers 9 x 15—10 x 16—24 x 36—36—60 x 84
Dry Pans 5, 9, and 10'
24 car truck dryer—no cars
Cranes—3—2 ton 18 ft. span
800' I beam monorail
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Tanks—many sizes
Crushing Rolls—36x16 Allis Chalmers—Jaw Crushers
2—Rotary Kilns 30" x 40'—54 x 20—5 x 50

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30—50 to 500 Gal. Copper Jacketed Kettles.
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12", 18", 24" and 30" closed delivery Filter Presses
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Hammer Mills, Ball Mills, Pulverizers.
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225 gal. Steel Jacketed Agitated Kettle.
PFAUDLER Glass Lined Jacketed Kettle, Agitated, 2100 gal., open top.
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(Continued from page 344)

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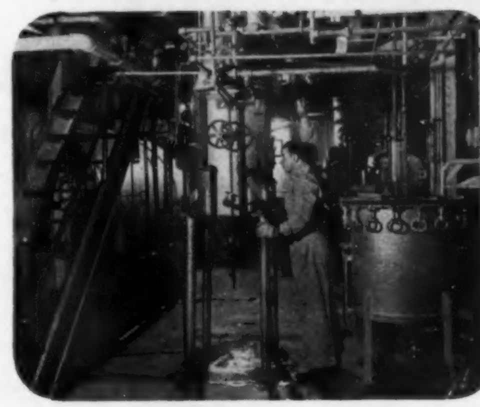

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